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Vol. I, No. 3, September 1954 *Eugenics Quarterly*

EDITORIAL COMMENT

Family Allowances

The United States has followed the lead of Western European countries in the enactment of social legislation, but usually after a good many years have gone by. Unemployment insurance and other social legislation were introduced in England about 1912 and in the rest of Europe at about the same time. Twenty years later similar measures became law in the United States. Health and maternity measures seem to be following the same course. If the analogy should hold we would soon be in for family allowances in the United States, for they are now universal among all other peoples of European descent, including Britain, Australia, and our neighbors the Canadians.

Recently we have had a lively public interest in this field. The article on International Family Legislation in the December 1952 issue of EUGENICAL NEWS resulted in an unprecedented number of requests for reprints, especially from Catholic organizations. Family allowances have been in the news. In the April 1954 issue of *The Reporter,* an article on family allowances forecast that the next depression would see legislation for payments for the support of children. With such a possibility in the offing, it is time to give thought to the form such legislation might take. A bad system of help to children could be very harmful.

Experience in Other Countries

The motivation for family legislation has usually included the desire to raise the birth rate (especially strong in France) or to provide better care for children in families at the lower income levels (as was especially the case in the Commonwealth countries).

The allowances paid run from five to ten dollars per month per child. Even at these low figures they total a large item in the national budgets. ($400,000,000 for Canada with a population of 25 million). Studies made on the effect of these payments do not indicate that they have had much if any influence on birth rates. Other factors are apparently for more important. But in countries like France, where wages are low compared to those paid in the United States, the allowances have made it possible to raise a family of children at a nutritional level which without the allowances would have been insufficient. French demographers are universally enthusiastic, and some lyrical in their praise.

It is sometimes argued that the low level of productivity of the worker in many countries makes a supplemental wage necessary if there are going to be healthy children in the next generation, and that this would not be the case in a country like the United States. Here worker productivity and wages are such that even the ordinary wage permits of a wide range and choice of expenditures; several children may mean less luxuries, but still plenty of food. But in Canada, with wages comparable to those in the United States, family allowances seem equally popular, as indicated in the interesting article by Rosalind Chambers in the March 1954 issue of EUGENICS QUARTERLY.

American Conditions

In the United States, in contrast to Europe, there is little concern about birth rates being too low, and the proportion of children who are undernourished is relatively small. Further increase in our numbers is more likely to reduce than to improve our national well-being. It is doubtful if even our military strength would be increased by our having more than the 200 million people we will quite surely have in another generation. We cannot compete in numbers with countries like

India and China whose people are more than twice as numerous as ours; nor in the long run with Latin America and Africa whose populations will probably be twice ours in another fifty years. We can only compete in quality.

With respect to nutrition and other factors affecting the quality of children, our situation is again different from that of Europe. A larger proportion of parents are able to give their children the food and other environmental conditions necessary to their proper growth. Families where the parents are unable to work, or where homes are broken, are cared for by combinations of county, state and federal aid, in some relation to their needs. In these cases a fixed family allowance would be an expensive and inefficient way of providing relief. Families subject to income tax—and these include 74 per cent of all the families in the United States—have the benefit of a $600 deduction for each child. At the 20 per cent rate which applies on income above $4000 a year, the saving to the parents is probably as great as any allowance likely to be paid them under a family allowance system. For those with larger incomes the saving is even greater. Between these two groups, the marginal families on state and county aid, and families with income of $4000 or more, there remain the families whose income is so small that they pay no substantial income tax, who find it difficult to care properly for their children, yet are not candidates for relief. Children in such families would undoubtedly be benefited by a federal payment of $10 per month, given without any means test. But this would seem an expensive way to meet the needs of this group. School lunches, maternity benefits, child clinics, already in wide use, might be expanded to offer more help to parents with large families in this low income group, at much less expense than the cost of family allowances.

Family allowances, even low ones, are in the aggregate expensive because there are so many of them. Ten dollars a month paid to each of 40 million children under 15 in the United States would total $4,800,000,000. This is a tidy sum to add to our national budget. Yet it would pay only a fraction of the cost of properly caring for the children. It would certainly be justified to prevent undernourishment, if this were the only means. But for this purpose, free school lunches would be more effective and less expensive. As we go on with the list of "necessities," the same question comes up. If medical care is not adequate, wouldn't it be better to provide more free clinics, more maternity and health benefits, than to expect parents to pay for these things out of a $10 monthly allowance? Or should we go the whole way and provide allowances of $500 or more a year, sufficient to cover all of the necessary costs of rearing the child? The cost to the United States would be some $20,000,000,000 a year, but parents would no longer have to worry about being able to meet their responsibilities to their children. This would be the family allowance plan brought to its logical conclusion.

It can be argued that under such a plan every child would be well fed and well clothed. But it is less likely that in most cases his psychological environment would be improved. Diminishing the responsibility of parents for the physical needs of their children is not likely to increase their responsibility for meeting their affectional needs.

Effect on the Distribution of Births

Most important of all is the question of what kind of parents would have the most children under a system of family allowances. For this question concerns not only the kind of home the child would be reared in, but also the kind of genetic inheritance which would be passed on to the next generation. This question should be examined in the light of the increasing use of birth control and the likelihood that greatly improved means of control will be available in the near future. When, in this way, parents become increasingly free to limit the number of their children, they are more than ever likely to weigh the responsibilities they will have to assume in having children against their desire for the children. When the responsibilities are heavy,

the desire for children must be very strong if they are to have a large family. *A priori* one would expect such people to be better parents than those who entered parenthood lightly in the belief that children would not be a burden. Cash payments each month would make raising children seem easy to many young couples who would be much less influenced by other types of aid such as school lunches, or free clinics.

If our purpose is to raise the quality of the homes in which our children are reared, we should try to create conditions under which a larger proportion of children would be born to the more responsible parents rather than to the less responsible. It is doubtful if cash family allowances would have this effect.

The eugenist is particularly interested because he believes that on the average the more responsible parents carry more valuable genetic strains than do the less responsible parents. He feels that before any action is taken on family allowances, their eugenic implications need to be carefully considered. More studies are needed before we can be sure of the answers. Eugenics stresses the responsibility of parents; it does not desire to see their sense of responsibility lessened. It shares with others the desire that responsible parents should be able, if they want, to have large families without impossible handicaps to their nutrition, their health and their education. Eugenics seeks variety at a high level of intelligence and character. We are not sure that family allowances are the best means to these ends.

WORLD POPULATION CONFERENCE PAPERS

The following papers (I-VI) were among those presented at the World Population Conference in Rome, September 1954 under the auspices of the United Nations. They will be published in the Proceedings of the Conference at a future date.

I. THE BREAK-UP OF ISOLATES

Its Genetic Consequences in Two French *Départements**

JEAN SUTTER
LEON TABAH

THE THEORY OF PANMIXIA, made use of in the genetics of population, presupposes numerous exceptions in actuality. The disappearance of consanguineous marriage in a recent period clearly reveals that marriage customs have evolved to a great extent from one generation to another. The break-up of isolates is examined here in reference to two French *départements:* Loir-et-Cher (population 240,000) and Finistère (population 750,000). In both cases we are concerned with two periods: Loir-et-Cher 1919–1925 and 1944–1953; Finistère 1919 and 1951–June 1953. Changes in frequency of consanguineous marriages are studied for each *commune,* of which there are as many as 297 in each *département.* The break-up of isolates appears as a recent phenomenon and its consequences on the genetic structure of the population are important, as is shown by statistical studies limited to the most endogamous *communes.* Mortality must have been lowered automatically thereby.

*More complete results will be published in *Population,* journal of the Institut National d'Études Démographiques (Paris).

I

The genetics of population in its essential theories poses the hypothesis of panmixia; in other words, the population is enclosed, marriages are made at random, and fertility is identical for all couples. This hypothesis is far from the true facts; six exceptions can be distinguished thus far to panmixia: (1) selection (differential fertility); (2) consanguinity; (3) choice of spouse; (4) mutations; (5) migrations; (6) the full complement and the limits of the population. It is not necessary for the population to be unlimited for panmixia to be realized. One can imagine that marriages are contracted at random in populations large or small. There exists, however, an essential difference between the two extremes. The distribution of genotypes turns out to be stable in the course of time if the complement of the population is sufficiently great. If the complement is reduced, this distribution becomes modified from one generation to another. Again in this last case the population must be enclosed; otherwise the migratory exchanges would act in the same manner as an increase in the complement.

In actual fact the population of one nation is divided into segmented populations in continual transformation. Dahlberg has called isolate each one of these populations of limited complement within which an individual can find his spouse. We know now that there exist purely demographic isolates or isolates of a religious, ethnic, social, or professional origin. Presumably isolates, before the development of industrial civilization, must have maintained from ancient times a certain rigidity and a stable make-up. This stability would have been destroyed in the course of the nineteenth century by the development of industries, transportation facilities, the extension of migration, etc. We have few precise data on the extent of this phenomenon, which has been called the break-up of isolates. We have tried here to establish some data, both past and present, on this problem while studying the evolution of isolates and its genetic consequences in two French *départements*.

As in Dahlberg's hypothesis we assume that within the *communes* or groups of *communes* studied marriages are made at random. Therefore the number of consanguineous marriages testifies to the size of the isolate, that is, to the number of individuals among whom the spouse can be chosen. The exactness of this hypothesis will be verified subsequently by examining the distance existing between the residences of the spouses.

II

The two *départements* under consideration are Loir-et-Cher (Loire Valley) and Finistère (Brittany). Both are little urbanized. The former can be considered as representatives of 35 or 40 French *départements* where exogamy seems to have prevailed for a long time; the latter ranks among the 10 or 15 *départements* where endogamy has remained strong until now. Finistère differs from Loir-et-Cher mainly in three respects: the frequency of consanguineous marriages has remained high until recently; there are fewer outsiders; and fertility is greater, since it can be estimated that the mean family size is greater by one than that of Loir-et-Cher.

As in our previous studies, the statistics on consanguineous marriages are based on religious dispensations granted by ecclesiastical authorities consisting of the following degrees: between uncle and niece and aunt and nephew (third degree); first cousins (fourth degree): cousins of unequal degree (fifth degree), the issue of first cousins (sixth degree); and double cousins. The ecclesiastical statistics are compared with the state marriage statistics to allow for the possible incidence of purely civil marriages.

Thanks to the archives of the Bishop of Blois (Loir-et-Cher) we have been able to establish valid statistics on the rate of consanguineous marriages during several periods between 1812 and 1953: 1812; 1826–1857; 1870–1877; 1891–1953. The character of the development of the frequency of these marriages is as follows: from 1812 to 1835 it is roughly constant (between 2 and 3 per cent) with only one or two years running higher figures than these; it then rises above 3 per cent and, except for a few years at 4 per cent, in actual fact remains there until the First World War, when it falls slightly. This frequency returns to 4.1 and 3.7 per cent for 1919 and 1920, respectively, only to fall once more. In 1923 it is at 1.9 per cent, maintaining itself roughly at this figure during the following years, only to slump finally from 1931 onward (0.9 per cent). It rises only slightly during the Second World War. During the fifties it falls to 0.4 and 0.5 per cent.

A few comments can be made on this 150-year development. The increase of the years 1830–1835 coincides with a demographic expansion; the population of Loir-et-Cher then increased rapidly from 211,000 to 270,000 inhabitants, which could explain the increase of endogamy. The

influence of wars is conspicuous: the war of 1870–1871 had brought about a slight increase which was shown again in 1914–1918, this time in a definite manner, and, less strongly, in 1939-1945.

For Finistère we have precise figures only after 1911. Figure 1 shows the development of the frequency of consanguineous marriages since this date in comparison with Loir-et-Cher. We see that the decrease has been rapid since the Second World War as the rate changes from 5.6 per cent in 1919 to 0.6 per cent in 1946. It is easy to see that the two curves have the same profile. The influence of the two world wars, if not simultaneous, is equally clear. The important thing is to establish whether or not there exists a displacement of 15 years between the two terminal points of the development of the number of consanguineous marriages; the situation in Finistère since 1946 is comparable, in all its elements, with that in Loir-et-Cher since 1931. This fact, added to the picture given us by Loir-et-Cher for 150 years, shows that the theory that isolates have been breaking up since the beginning of the nineteenth century is not exact, at least if we restrict ourselves only to the example of France. This breaking up seems to be a recent phenomenon which has had repercussions largely on the existing generations. Let us now estimate the breadth of this phenomenon while examining what took place at the level of each of the communes of the two *départements*.

III

On the basis of the preceding data, we have studied the development of isolates in the course of one generation, that is, from 1919 to 1953. Table 1 shows the period studied in Loir-et-Cher with their demographic characteristics (census of 1921 and 1946):

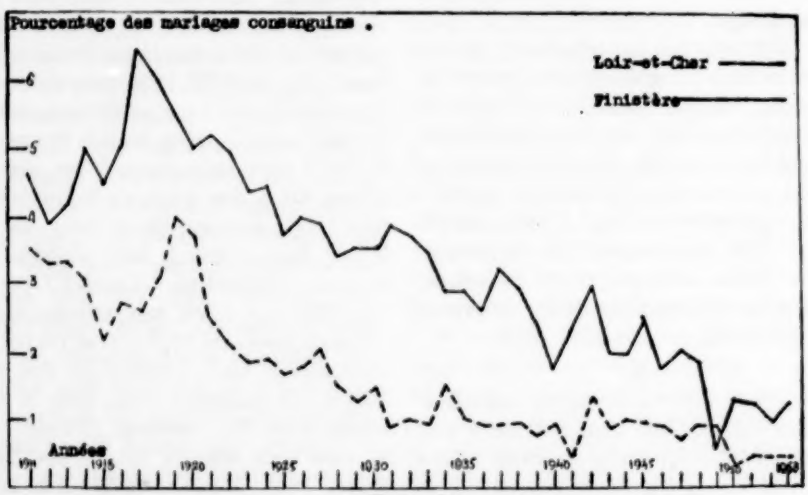

Figure 1
The development of the frequency of consanguineous marriages (1911–1953)

TABLE 1

Periods Studied	No. of Inhabitants	No. of *Communes*	Total Marriages	Consanguineous Marriages	
				No.	%
1919–1925	251,228	297	19,431	551	2.8
1944–1953	242,419	297	19,861	149	0.7

The ecclesiastical archives of Loir-et-Cher allow us to distribute the spouses according to the *commune* of their origin. Apart from these figures we have been able to establish for each *commune* the number of consanguineous spouses per 1,000 inhabitants. If the consanguineous spouses had been distributed homogeneously throughout the whole *département*, we should have found 4.4 per 1,000 inhabitants during the first period under consideration and 1.2 during the second. According to these figures, the *communes* were distributed as in Table 2.

According to the 1919 figures, 4.4 and over, the number of *communes* fell from 120 to 20. According to the 1944–1953 figures, 1.2 and over, the number fell from 220 to 88. We see that the disappearance of consanguineous marriages from one period to the other is not at a rate corresponding with the figures; the disappearance is more evident in the higher figures. A more searching study would show that this is in accordance with a purely demographic factor: the number of inhabitants per *commune*. We may add that each of the six natural geographic regions of Loir-et-Cher presents its own evolutionary character.

For Finistère the years studied with their demographic characteristics (census of 1921 and 1946) are shown in Table 3.

Ecclesiastical statistics do not allow us to establish the number of consanguineous spouses per *commune* but only the number of consanguineous marriages per 1,000 inhabitants. (See Table 4).) If they were distributed homogeneously throughout the *communes*, we should have had 0.9 per 1,000 inhabitants in the first period and 0.2 in the second.

TABLE 2

Consanguineous spouses per 1000 inhabitants	12 and over	8–11.9	5.6–7.9	4.4–5.5	Total *communes*
1919–1925	28	27	31	34	120
1944–1953	3	4	7	6	20
Consanguineous spouses per 1000 inhabitants	**3–4.4**	**2–2.9**	**1.2–2.9**		**Total *communes***
1919–1925	43	33	24		100
1944–1953	19	27	22		68

TABLE 3

Periods Studied	No. of Inhabitants	No. of *Communes*	Total Marriages	Consanguineous Marriages No.	%
1919	762,514	298	12,897	726	5.6
1951–1953	724,735	294	13,000	161	1.2

TABLE 4

Consanguineous marriages per 1000 inhabitants	3 and over	2–2.9	1.4–1.9	0.9–1.3	Total *communes*
1919	22	30	35	36	123
1951–1953	1	2	9	18	30

Consanguineous marriages per 1000 inhabitants	0.8	0.7	0.6	0.5	0.4	0.3	0.2	Total
1919	15	14	13	10	9	12	5	78
1951-1953	4	12	10	10	14	4	6	60

At the 1919 rate, 0.9 and over, the number of *communes* fell from 123 to 30; at the 1951-1953 rate, 0.2 and over, from 201 to 90. As in Loir-et-Cher, we can see that the highest rates are the ones affected by the decrease. Geographically, the distribution is also very significant.

IV

The preceding material shows the profound modification undergone by marriage in the course of the last 30 years. A study of the size of isolates, reckoned from the percentage of marriages of the sixth degree, provides supplementary proof of this. The totals are recorded in Tables 5 and 6 both for the *départements* and for the most endogamous *communes* of each. They show the number of persons from among whom, during two different periods, spouses could have been chosen. The entirely theoretical aspect of these figures should be kept in mind, which nonetheless have the advantage of externalizing phenomena which are in actuality very complex.

The absence of figures indicates that there were no longer any consanguineous marriages of the sixth degree in the periods under consideration.

V

This increase in the dimensions of isolates appears again when we examine its importance with the aid of mean coefficients of consanguinity. Table 7 shows how these coefficients have varied in the group of *communes* which we have just cited, and for the periods studied.

In these, the most endogamous communes, the decrease of the mean coefficient of consanguinity is due above all to the quasi disappearance of marriages of the fourth degree. On the other hand, marriages of the sixth degree still represent 2.5

TABLE 5

LOIR-ET-CHER

Totals: 1919–1925: 1,620
1944–1953: 5,400

Communes	Periods 1919–25	1944–53	*Communes*	Periods 1919–25	1944–53
Conan	108	—	Chaumont sur Loire	300	1,246
Chapelle St. Martin	116	506	Selommes	311	953
Arville	135	405	Courmemin	324	—
Saintes Gemmes	147	—	Gombergean	438	—
Nourray	162	—	Verdes	476	—
Candé sur Beuvron	188	—	Fontaine en Sologne	624	1,246
Feings	208	810	Saint Agil	810	266

All: 1919–25: 270; 1944–53: 810

TABLE 6

FINISTERE

Totals: 1919 : 1,565
1951–1953: 4,000

Communes	Periods 1919	1951–53	*Communes*	Periods 1919	1951–53
Ile de Sein	310	—	Beuzec cap Sizun	2,372	1,551
Primelin	695	—	Goulien	1,344	—
Plogoff	791	672	Esquibien	1,399	1,061
Plozevet	896	2,688	Meillars	1,920	683
Plouhinec	1,090	8,064	Mahalon	2,016	707
Penmarc'h	1,301	3,360			

All: 1919: 1,061; 1951–53: 2,122

TABLE 7

LOIR-ET-CHER		FINISTERE	
1919–1925	1944–1953	1919	1951–1953
418.80×10^{-5}	102.10×10^{-4}	271.45×10^{-4}	46.98×10^{-4}

TABLE 8

		LOIR ET CHER		FINISTERE	
		1919–1925	1944–1953	1919	1951–1953
1 characteristic	$p = 10^{-1}$	16.3	5.2	10.5	2.9
	$p = 10^{-1/2}$	21.9	6.8	14.4	3.4
2 characteristics of same gene frequency	$p = 10^{-1}$	22.0	7.2	14.5	4.2
	$p = 10^{-1/2}$	39.1	12.4	28.1	6.2

per cent of the marriages in Loir-et-Cher and 1.8 per cent of the marriages in Finistère.

For the periods studied we have inquired into the theoretical number of carriers of one or two characteristics born of marriages of the fourth to the sixth degree per 100 carriers in the total population. We have adopted the simplest hypothesis, that of monohybrid, autosomic, and recessive characteristics, and we have assumed that the gene frequencies were 10^{-1} and $10^{-1/2}$ in the population. Table 8 shows the results of this calculation:

We see that the carriers of one characteristic, and even more the carriers of two characteristics, were relatively numerous in the period following the Second World War among the descendants of consanguineous marriages, even when the characteristics were very widespread in the population ($p = 0.1$). In Loir-et-Cher, in 1919–1925 nearly 40 per cent of the carriers of two characteristics (the gene frequencies of which were $10^{-1/2}$) would have theoretically been the issue of marriages of the fourth to the sixth degree, which nevertheless represented only 12 per cent of the total marriages. Nor have we yet taken into account the possible recombinations between loci. It has been shown that one of the effects of a strong endogamy is the augmentation of the frequency of carriers of several characteristics, for, among consanguineous couples, the frequency of multiple recessives is more greatly increased than of simple recessives, compared with non-consanguineous couples. This phenomenon is more especially pronounced as the variance of the coefficients of consanguinity of the various couples constituting the population is small, which is the case among the most endogamous populations.

The influence of consanguinity in causing rare characteristics to appear has lessened considerably in recent years as a result of the great decrease in marriages of the fourth degree. Variance in the coefficient of consanguinity must have simultaneously increased greatly.

It should be emphasized that the preceding computations assume that unions other than those of the fourth to sixth degree have negligible coefficients of consanguinity. But this evaluation appears doubtful for the *communes* studied, for endogamy is particularly strong there; unions of the sixth degree are relatively numerous, and it seems hazardous to assume that unions of the immediately higher degrees are almost non-existent. On this basis, the figures obtained above ought to be considered as overestimated, especially for the earliest period. Although this cause for error is not negligible, it cannot be denied that the decrease in the rate of consanguinity has resulted in the marked lowering of the frequency of the rarest characteristics.

VI

To show the importance of this transformation of marriage to the level of the great demographic problems, we have exhaustively studied the death rate in eight

TABLE 9

Families		Stillbirths	Other deaths	Survivors	Number of children
	No.				
Consanguineous	174	16	89	386	491
		(33) •	(181)	(786)	
Non-consanguineous	281	16	86	715	817
		(20)	(105)	(875)	
Total		32	175	1,101	1,308

Comparison of the two distributors: $x^2 = 18.24$ $P<0.005$

•Figures in parentheses are per 1,000

communes of Finistère: Plozevet, Esquibien, Goulien, Ile de Sein, Cleden cap Sizun, Plogoff, Primelin and Mahalon. From 1919 to 1929 there were 1,893 marriages in these *communes*, of which 183 were consanguineous from the third to the sixth degree. Comparison of mortality, at different ages, among the descendants of the 183 consanguineous marriages and among the descendants of 281 families taken at random from among the 1,710 non-consanguineous has given the results in Table 9.

We see that the break-up of isolates has contributed by a far from negligible fraction to the lowering of mortality in these *communes* from one generation to the other. We can say in closing that the profound changes which have recently taken place have strongly influenced the genetic structure of the populations studied and their demographic constants.

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II. TESTED INTELLIGENCE AND FAMILY SIZE

Methodological and Interpretive Problems

ANNE ANASTASI
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WITHIN THE PAST THREE decades, the relationship between intelligence test scores and family size has been repeatedly investigated. Among such studies, the outstanding examples are the surveys conducted on nearly complete samples of 11-year-old Scottish children (22, 23).[1] In all investigations in which the intelligence test scores of unselected school children were correlated with number of *siblings*, the results have been quite consistent. The correlations are invariably negative and cluster numerically in the .20's or low .30's (4, 5, 6, 7, 8, 10, 14, 17, 21, 22, 23, 26). Within certain more narrowly defined subsamples of the general population, results vary. For example, among college students, nearly all surveys agree in finding no significant correlation between intelligence and size of sibship (12, 18, 25, 29, 30). Similarly, there is some evidence that within the professional class the correlation may be zero or even positive, while within other occupational categories it is negative (cf. 5). On the other hand, the usual negative correlation in the .20's was found within a group of intellectually superior children tested at the elementary school level (27).

Data on the relation between parental intelligence and number of *offspring* are very meager, but suggest an absence of significant correlation, especially when completed families are studied (9) or when amount of parental education is ruled out (32).[2] It cannot be assumed that the relationship between intelligence and number of siblings is the same as that between intelligence and number of offspring. In this connection, it should be recalled that the correlation between parental and child intelligence is only about .50, thus leaving room for considerable variation. Moreover, we cannot assume that children coming from larger families will themselves have correspondingly large families. Among other factors, social mobility will affect the fertility pattern of such individuals. More direct information on the relationship between parental intelligence and number of offspring would be helpful in disentangling the causal interrelations of factors.

Theoretical Analysis of Causal Relations

The problem of causal relations is a far more difficult one than that of determining correlations. It is especially important in this connection to differentiate clearly between plausible hypotheses and empirically established facts, and to ferret out tacit assumptions which may underlie our interpretations. For example, if we define intelligence in terms of hereditary predispositions, we shall logically preclude the possibility of discovering that certain individual differences in intelligence may be unrelated to gene constitution. It is more consistent with scientific method to employ definitions which do not prejudge the data but which permit the maximum freedom of interpretation.

We may, of course, define the word "intelligence" to mean anything we choose. All studies on intelligence and family size, however, have employed intelligence test

[1] The numbers in parentheses refer to an appended bibliography.

[2] In a critique of this study (20), there appears to be a misunderstanding of the data reported. Subjects' intelligence correlated —.02 with number of *offspring*, but —.12 with number of *siblings*.

scores as their index of intelligence. It is evident, therefore, that our interpretations must take intelligence test scores as their point of departure.

When intelligence is defined in such terms, we may recognize three distinct etiological mechanisms whereby the obtained correlations between intelligence and family size might result. It is understood, of course, that the actual causal relations may involve any combination of two or all three of these mechanisms. First, there may be inherited structural factors (neural, glandular, etc.) which limit the sort of intellectual development measured by current intelligence tests. The less intelligent parents would thus transmit their structural limitations to their offspring. The obtained correlations would then result from the fact that, within a given culture, persons with inferior heredity tended to have more offspring.

A second familiar explanation attributes individual differences in children's intelligence to psychological differences in the environments provided by parents of varying intellectual levels. In this case, the correlations between family size and intelligence of offspring would again result from a tendency for the less intelligent parents to have more children, but heredity would not be involved. It should be added that the child's intellectual development may be influenced, not only by the nature and extent of direct intellectual stimulation afforded by his home, but also by emotional and motivational factors deriving from the "social climate" of the home. There is a growing body of data pertaining to differences in child-rearing practices in various socio-economic levels and other sub-cultures (3, Ch. 23 and p. 734). Some of these differences, such as the degree to which verbalization and exploratory behavior are encouraged or discouraged, are likely to influence the child's intellectual development.

A third possible interpretation is based upon size of family itself as a causal factor. For example, a larger family—at least in certain socio-economic levels—would reduce the per capita funds available for education, recreation, suitable housing, proper food, medical attention, and other environmental requisites. From a psychological viewpoint, another important factor is the degree of adult contact provided in families of different sizes. Available evidence suggests, for example, that such contact may be the most important single factor in linguistic development (3, pp. 335–339; 16). And it is well known that verbal ability plays a major role both in educational progress and in intelligence test performance. Whatever the specific factors involved, the causal mechanism under consideration is independent of the intellectual level of parents. A crucial test of this hypothesis would thus be found in the correlation between size of sibship and intelligence of offspring, when intellectual level of parents is held constant.

It is clear that the three hypotheses differ significantly in both their theoretical and practical implications. One fact remains, however, regardless of which hypothesis, or combination of hypotheses, may ultimately prove to be correct. Insofar as a significant negative correlation is conclusively established between intelligence test performance and family size, it follows that mean intelligence test scores of the population should decline slowly in successive generations, unless other counterbalancing influences operate. Theoretically, such counteracting factors might be genetic (cf., e.g., 19). It is more likely, however, that they would be environmental.

Implications of Follow-up Surveys

In an effort to obtain direct evidence regarding the predicted decline, follow-up procedures have been employed, whereby comparable samples are tested under similar conditions after a lapse of several years. Again the most notable example of such a study is to be found in the Scottish survey

(23, 24), in which a second approximately complete sample of 11-year-old Scottish children was given the same group intelligence test 15 years after the testing of the initial sample. As is now well known, this survey revealed a small but significant rise in mean score, rather than a decline. Similar gains have been found in other surveys. Although not so extensive or so well controlled as the Scottish survey, especially with regard to comparability of samples, these other surveys have yielded consistent results.[3]

Reference may likewise be made to certain relevant data gathered incidentally, as by-products from other types of testing programs. Thus an analysis of the intelligence test performance of American soldiers in World Wars I and II indicated that the level of performance had improved to such an extent that the median score of the later sample corresponded to the 83rd percentile of the earlier sample (28). This rise in score paralleled an increase in amount of education, the mean being at the 8th grade for the first sample and at the 10th grade for the second. It is also noteworthy that a survey of the intelligence test performance of American high school students over a 20-year period suggested that this, too, had improved, despite the marked increase in the proportion of students enrolled in high school (11). Since a larger proportion of the total population was attending high school at the end than at the beginning of this 20-year period, a decrease in mean score would be expected, unless the total population had improved sufficiently to counteract such a drop.

When educational and other environmental conditions within a given community improve conspicuously, larger rises in test scores may be observed over even shorter intervals. Thus a 10-year follow-up conducted in a relatively isolated mountainous region of Eastern Tennessee showed a 10-point rise in median IQ (31). During this interval, the socio-economic and educational conditions of this region had greatly improved. The second sample tested in this survey was closely comparable to the first, the children coming largely from the same families in the two cases.

That intelligence test performance is susceptible to improvement as a result of education has been more directly demonstrated in at least two investigations in which persons who had been tested following a uniform period of universal education were retested after 10 years in one case and after 20 years in the other (13, 15). In the intervening years, members of these groups had received varying amounts of further education. Both studies report significant relationships between amount of subsequent schooling and retest performance, when initial scores are held constant.

A question that is frequently raised in connection with all such improvements in test performance pertains to the role of test sophistication and other conditions which might spuriously raise test scores. Fundamentally, the answer to this question depends upon the *breadth* of the effect (1; 2, pp. 52–56). Any influence which is restricted to the test performance itself and does not correspondingly affect the criterion behavior which the test is designed to predict would of course reduce the validity of the test. But the broad educational and social conditions under consideration can be expected to affect the individual's overall intellectual development, rather than being restricted to the particular samples of behavior included in psychological tests.

Methodological Problems

Apart from questions of interpretation, investigations of the relationship between family size and intelligence are beset with methodological pitfalls. Since the obtained correlations are so low, the operation of

[3] In the relatively few instances in which discrepant findings are reported, lack of comparability of samples seems to provide an adequate explanation.

selective factors, however slight, may produce a completely spurious result. An example of such a selective factor is provided by a study conducted within an American women's college (25). Within the entire group of 2261 entering students for whom test scores were available, a significant inverse relation was found between test scores and number of siblings. This relationship disappeared, however, when the records of those whose older sisters had attended the same college were excluded. Presumably somewhat lower entrance requirements had been applied to those whose siblings had previously matriculated. Such students would also be likely to come from larger families. Many other examples of institutional selective factors could readily be cited. It is when such factors affect the correlation between the variables under consideration that they create a particularly serious problem.

Nor are more general samples free from selective factors. Thus in a sample of children between, let us say, the ages of 8 and 14, individual large families will appear repeatedly within the sample, the number of re-appearances being directly proportional to the size of the family. A family containing five school-age children, for example, would appear five times in the sample. Any chance conditions characterizing individual large families would thus be spuriously magnified in the sample. Nor would ordinary sampling statistics be strictly applicable to such samples. It is partly to avoid such difficulties that single-age samples, such as 11-year-olds, have been utilized. Even in such a carefully chosen sample, however, certain selective factors will operate. For example, large families will be over-represented, since by chance a child of any specified age is more likely to be found in a large family than in a small one. Such a sample is therefore not representative of existing families, nor of the parental populations. With regard to the child population, it can be argued that large families should be over-represented, since they contribute more members to the population. Nevertheless, certain types of comparisons may be distorted through the use of a single-age sample.[4]

In the case of follow-up studies conducted within a limited area, such as a single city or county, any *selective migration* which may have occurred in the interim will reduce the comparability of initial and subsequent samples. Similarly, differences in thoroughness of sampling procedures on successive testings may introduce differential selection. For example, subjects in lower socio-economic levels or those who are physically less fit are more likely to be excluded when sampling coverage is less adequate.

Another recurrent difficulty arises from the presence of *incomplete families* in the sample. This factor may operate in a number of different and not entirely predictable ways. All children from such incomplete families are, of course, classified as coming from somewhat smaller families than will eventually be the case. This may have the effect of classifying lower test-scorers (from the ultimately larger families) into a category of higher test-scorers (from smaller families). Such a procedure would thus reduce the obtained differences in test scores between the various family-size categories. On the other hand, when a negative correlation is found between intelligence and family size in a sample of incomplete families, it may simply reflect the tendency for persons of lower intelligence to begin having children earlier. Should such persons also stop having children earlier than the more intelligent members of the community, the correlation would disappear when completed families are studied. There is evidence that, at least in one rural American community, such was actually the case (9).

It should be noted, of course, that if the

[4]Cf., e.g., the analyses of order of birth and of maternal age reported in 23 and 24, respectively.

less intelligent parents begin having children earlier than the more intelligent parents, they will contribute more individuals to the population in the long run, through more frequent generations. For example, if each successive generation begins to bear children at age 20, there will be five generations per century; while if childbearing begins at age 25, there will be only four generations. Nevertheless, the effect upon the intelligence level of the population would be less if the duller parents merely began to have children earlier than the brighter, than it woud be if the duller also had larger completed families than the brighter.

Age of parents is a factor which needs to be considered in its own right. The smaller families in a sample may include a relatively large proportion of incomplete families of younger parents. Such parents are likely to be better educated than the older parents of the completed families, owing to the progressive rise in educational level of the population. The better educated parents would in turn provide a more favorable environment for their offspring. *Thus when incomplete families are included in the sample, the differences in parental age, coupled with the rising level of general education, might be sufficient to account for the negative correlation found between family size and intelligence.*

As we pass from sampling problems to testing problems, we must consider such questions as the *reliability* of the measuring instrument, a question which assumes special importance in view of the small group differences in scores which must be detected in such studies. It is also desirable that the test cover an *adequate difficulty range*, to permit a proper determination of the ability of persons at the extremes of the distribution.

The use of *different tests*, or different forms of the same test, in follow-up studies presents a number of problems, such as variation in functions tested, differences in standardization samples, and lack of comparability of units. A particularly dangerous practice, which should be avoided if at all possible, is that of converting scores from one test to another. Nor is it advisable in precise studies to use the traditional *ratio IQ*. This measure has many disadvantages which can be avoided by employing standard scores or deviation IQ's.

Finally, it must be noted that "intelligence" is not a unitary function. Research on the organization of abilities has revealed a number of relatively independent traits or *group factors* (cf. 2, 3). As examples may be mentioned verbal comprehension, word fluency, speed and accuracy of numerical computation, spatial visualization, perceptual speed, associative memory, and numerical reasoning. A single global score, such as an IQ on an intelligence test, meaures a conglomerate of heterogeneous abilities combined in unknown proportions. Let us suppose that two individuals obtain an IQ of 120 on the same intelligence test. The first may have done so because he excels markedly in verbal comprehension, is about average in numerical reasoning, and is slightly inferior in spatial visualization. The second may have obtained the identical score by virtue of a superior performance in numerical reasoning and spatial visualization and a low average performance in verbal comprehension. Such a state of affairs obviously makes for ambiguity. It is certainly more precise to describe the individual's intellectual status in terms of a profile of scores on the traits identified through factor analysis, rather than in terms of a single, hodgepodge IQ.

In conclusion, it may be well to consider the sort of experimental design suggested by the theoretical and methodological questions which have been discussed. The ideal investigation should begin with the testing of young people prior to their educational and vocational differentiation, *i.e.*, after all have completed a uniform period of required schooling. Preferably the tests

should consist of a differential aptitude battery yielding a profile of scores rather than a single global score. The subjects should be followed up until the age when all, or nearly all, of their families are completed. Age of both parents at the birth of their first and last child should be noted. Records should also show deaths, unmarried persons, and childless marriages. Information should likewise be gathered on occupation, income level, and amount of subsequent education for each member of the group.

Additional questions can be answered if test scores of the children of these persons are studied. But many problems can be solved even prior to this step. From a practical viewpoint, such a program is not too unrealistic, especially in nations where uniform psychological tests are administered in the school system and where detailed census data are regularly collected. From a theoretical standpoint, this approach would help to separate the many interrelated variables which are now so intricately intertwined.

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III. NEEDED RESEARCH

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THE RESULTS OF HALF a century of intense studies on the behavior of genes in individuals and in populations have provided a theoretical framework which often permits exact statements about the effect of population changes upon the distribution of genes. We know that in any natural population many, if not perhaps most, genes occur in several varieties or alleles usually present in various frequencies. Therefore the individuals of a population form a considerable array of different genotypes in relation to any specific genic locus. Since the different genotypes at one locus become recombined in all possible ways with those at other loci, the total number of possible genetically different types is immeasurably larger than that of any actually existing group of individuals. Therefore, with the exception of identical twins or multiples, no two individuals are ever genetically alike.

If all genotypes endowed their carriers with equal reproductive ability, if all individuals actually did reproduce at the same rate and if genes were completely stable, then in an infinitely large population the proportions of the different kinds of alleles would remain unchanged from generation to generation. In reality none of these conditions are fulfilled. We know of many genes which lower considerably the chances of their carriers to survive and reproduce the average number of offspring, accidental and systematic differences in the fertility of individuals exist independently of their genotypes, genes mutate, and, obviously, infinitely large populations are never encountered. Any one of these attributes tends to shift the proportions of different alleles from one generation to the next. While in many cases the simultaneous action of such factors as differential fertility and mutation may be opposed to each other and result in a dynamic equilibrium, in many other cases no constancy in proportion of alleles can be expected.

The different alleles are not distributed evenly over a whole species. Various genetic and evolutionary processes bring it about that every group, within which mating occurs more frequently than with outsiders, accumulates certain alleles and becomes deficient in others. In man, prehistoric, geographic, national, religious, social, and other factors have led to the establishment of numerous groups which on the average are genetically different from one another. Within each one of these groups only a fraction of the total array of genetic combinations is possible.

The knowledge required for an intimate understanding of the interrelations between demographic processes and changes in the proportions, combinations and distributions of genes consists primarily in specific items. If we knew enough about the genetic basis of relevant traits or combinations of traits, about the range of phenotypic expression of the relevant genotypes under the most diverse circumstances and about the average selective advantages or disadvantages of the various combinations of genes as they affect both the individuals and the population group of which they are a part, if we knew these and similar facts, then we could apply to them known general concepts and formulae. As it is, information is still incomplete on the relatively few traits, such as blood properties and specific abnormalities, which have formed the backbone of knowledge in human genetics, and it is all but absent for variants within the normal range of physiological, emotional and intellectual characters.

A well-known demographic phenomenon is the so-called breaking up of isolates. Often in history large-scale mixtures of previously relatively separate groups have taken place, in consequence of wars and conquest, of peaceful migrations and of the breakdown of religious, social or caste barriers. In recent decades two factors have facilitated the breakdown of isolates; namely the increased motility of individuals within many populations and, to a lesser extent, the approach, in many Western populations, to numerical stability. The increased motility has made possible a large proportion of marriages between persons from different localities thus breaking down isolates which often were the result of distance rather than of more complex geographic factors. The approach to numerical stability has resulted in a decreased number of first cousins and other close relatives who are potential marriage partners. For example, with an average of 3 children per family, an individual has 3 first cousins of the opposite sex. With an average of 2 children only a single first cousin is of the opposite sex. The changes in motility and average family size are in several countries reflected in a decrease of cousin marriages during the last century, from about 1 per cent to perhaps as little as 0.1 per cent.

The breakdown of isolates results in an equalization of the proportions of those alleles which were formerly different in the separate groups, in the disappearance or at least decrease in frequency of genic combinations which depended on the established allele frequencies within the isolates, and in the production of new genic combinations made possible by the intermixture. Only one, partial aspect of these classes of phenomena is sufficiently understood to be useful for a specific statement. This refers to the incidence of hereditary, physical and mental abnormalities which depend on recessive genes. If the frequencies of these genes vary in different isolates, then their frequencies take on intermediate values in the mixtures. Since it takes two recessive alleles to produce an affected individual, the frequencies of such individuals are functions of the square of the allele frequencies. From this it follows that the total number of affected individuals in the mixed population is less, and often very much less, than the sum of the affected in the original isolates. Thus the breakdown of isolates wherever it occurs should have led and continue to lead to a sizable reduction in the incidence of individuals with genetic diseases due to recessive genes. If this fact is not yet substantiated by data on vital statistics, then this is probably only the result of improved ascertainment; the increasingly greater portion of cases which becomes registered obscures a decrease in actual cases.

This decrease in frequency of homozygotes cannot be restricted to strikingly abnormal traits. It must likewise occur for those other homozygotes which are involved in the determination of various degrees and kinds of normal form and functions. But what are these? Do mean genetic differences in nutritional requirements, range of climatic tolerances and mental attributes exist between different major races, different populations, different minor partial isolates? We have good reason to suspect their existence but need facts instead of suspicions. If such genetic differences exist, do they rest upon homozygosity at single loci or interaction of different loci? Experiments with animals and plants show increasingly that many traits established by evolutionary processes depend on complex heterozygosity of genes at many loci. Is this true for significant human traits? If so, does the increased heterozygosity which results from isolate breaking lead to greater frequencies of desirable traits? Or is the heterozygosity within each isolate of a different kind than that resulting from mixture—the first adaptive, the second untested?

These questions not only touch upon the problem of evaluation of traits in terms of desirability and adaptiveness; they also cover a variety of cases each one of which will require a separate answer and raise additional questions. Thus during the last generations, mean stature has increased in many populations. It is likely—but not proven—that apart from improved nutrition and public health, increased heterozygosity is responsible for this change. Is larger mean size a desirable trait? Is the incidence of various causes of death or illness the same in people of different stature? What are the economic consequences of the changing food requirements in populations with changing body size? And what is the effect of increased heterozygosity on other measurable traits? May not some increase, like stature, while others decrease? Where do different mental attributes belong? Is, for instance, high intelligence performance favored by homozygosity, by specific heterozygosity or by heterozygosity in general? In the first and second alernative the breakdown of isolates may result in a lower frequency of the trait, but in case of the third alternative, in a higher frequency.

In a natural species the short-range effects of the breakdown of isolates are likely to result in reduced mean adaptiveness. This is the price paid for the creation of new genetic combinations, some of which may be the basis for new evolutionary trends. Is the domesticated species Homo sapiens subject to the same forces? Is genetically based specific human adaptedness still an important feature or does man's control of the environment—taken in the widest meaning of the term—tend to minimize the significance of genetic differences?

Many of these questions will receive different answers according to the genetic differences between the isolates. What effects the breakup of old-established genotypic arrays within major races will have may be different from the effects of the breakup of recent class and socio-economic groups. Differences between major races may involve striking differences in allele frequencies at many loci, while differences between isolates of recent origin may rest on lesser differences of few loci. We need data on the old question of the frequently ascertained and equally frequently denied origin of genetically conditioned disharmonies resulting from isolate-breaking!

The breakdown of isolates often consists not in a large-scale obvious intermixing of different groups—as for instance between Polynesians, Mongolians, Caucasians and others in Hawaii, or between different Caucasians in North America—but, in a more subtle fashion, in the "diffusion" of a relatively small number of genes from one group into another. This occurs particularly when the hybrids intermarry primarily with members of only one of the original groups. In this way an "introgression" of genes from one group into another is initiated. Plant breeders make good use of such a system of crosses. It has enabled them to transfer specific desirable genes, such as providing resistance to a certain pest, from one strain to another without destroying the over-all genetic integrity of the formerly susceptible strain. It is possible that a similar transfer has occurred in various parts of the world where the white man brought measles and tuberculosis to native populations which lacked genetic resistance to these infections. There, the survival of part of the native groups may have depended on the invader's resistance genes which he left within some of the hybrids whom he procreated. The often suggested genetic basis for the apparent inability of the European to establish permanent self-reproducing settlements in the tropics could conceivably be overcome by introgression of genes from climatically well-adapted populations, and the future of the tropics may possibly be influenced by the origin of new combinations resulting from the opposite intro-

gression of foreign genes into the native populations.

It is reasonable to assume the existence of genotypes conferring climatic tolerances or specific nutritional properties. Yet research is needed to support such assumptions. The study of well-defined physiological responses in the populations of first and later generation inter-racial hybrids which have originated in diverse parts of the world promises significant new insights.

Profound changes in the distribution of genetic factors occur as the result of differential fertility of groups with different corporate genic content. On the largest scale such changes have been brought about, and are still occurring, owing to differences in the reproductive rates of the major races. On a lesser scale differential reproductivity occurs between subgroups of relatively more homogeneous populations. When these subgroups are genetically different, differential fertility may lead to changes in the proportions of alleles in the whole group. It is well known that in many industrialized societies an inverse relation has existed recently between the socio-economic level of a subgroup and its reproductive rate. Since mean differences in mental test performances have been found to be correlated positively with socio-economic level, and since differences in genes are usually regarded as partly involved in differences in test performance, it has been postulated that changes occur at present in the frequencies of such genes. The undesirable direction of these changes has been characterized by the term "gene erosion." Actually, the effects of this group of phenomena can not be appraised at present. The result of differential fertility in terms of changes in genic frequencies depends not only on the average fertilities of different subgroups but also on the distribution of fertility within each subgroup. If genetically different individuals within subgroups also should exhibit significantly different fertility then, depending on the direction of intragroup differentials, the effect of intergroup differences may be either fortified or counteracted. Data on intragroup fertility are scarce, and the few available ones are restricted to the upper socio-economic layers. More complete information is greatly needed for all subgroups. Particularly, countries now entering an era of industrialization and increased birth control have a vital interest in an elucidation of these phenomena within their own populations.

Even if the facts regarding fertility were better known, the genetic effects of differential fertility in regard to mental traits would be difficult to evaluate. The heritability within the normal range of mental traits is still obscure. Moreover, it is to be expected that the genetic endowment of a group may show relatively high values for certain traits and low values for others. This statement not only involves the problems of evaluation of individual traits on scales but in addition those of evaluating the different traits in relation to each other. It should be possible, however, to assemble data on the genetic component of various mental traits and then, without value judgments, to determine the genetic consequences of differential fertility.

The presumed mean genetic differences between subgroups are partly due to social mobility which attracts genetically "preadapted" individuals to a subgroup as well as discharges from a subgroup individuals who are not adapted to it. Where social mobility is high, greater genetic differences may be found than where low mobility keeps most genes from selectively leaving a subgroup or being added to it. Information on social mobility is available for only a few societies. More is clearly desirable. The increased mobility in many societies may have important genetic consequences. It may lead to better use of the divergence of genotypes, but it may also expose certain alleles and combinations to the effects of selection in terms of reduced reproduction

from which they had been shielded in times of low mobility.

Reduced biological fitness due to genic causes is a potent factor which has counteracted the increase of abnormal traits which would result from new mutations. Preventive medicine and therapy have made possible the survival and normal mean reproductive performance of carriers which were formerly subjected to strong negative selective pressures. It is perhaps not too early to start compiling careful records of the total numbers of each kind of affected individuals in order to establish base lines from which to judge changes in later generations.

In this survey we have repeatedly referred to the problems of mental traits. The old problem of the relative roles of heredity and environment, and of their interaction in determining the range of variability is still with us, even though much progress has been made. The modern approach in animal experiments to learning ability and behavioral traits is contributing new concepts and, by the use of different breeds and different species, teaches us the existing variety of inborn attributes and the way in which they become phenotypically apparent—some in highly fixed patterns, others in equally highly plastic responses. More research in this field, on mammals, birds and other animals will help in the understanding of the interpretation of human mental traits. Specifically, however, man will have to provide his own data. Some of the methods which have been defined and applied to the study of twins and sibs reared apart, to half-sibs and foster children are limited primarily on account of the paucity of cases available in a single country. If worldwide studies were undertaken in these basic areas, many new relevant cases would become accessible and our knowledge would be greatly increased. In addition, a clarification of present arguments and counterarguments on the role of genetic and non-genetic factors in the expression of mental traits could be expected if long term and statistically satisfactory studies were made on the relation of pre-, peri-, and neo-natal experiences on the emotional and intellectual development of children and later, adults. Such studies seem to me eminently called for.

Research needed in the field of demography and population genetics will not soon lead to results which can be used for active interference with the uncontrolled forces which incessantly influence the distribution and frequencies of genes. They will, however, help us to understand what changes are occurring and what the genetic results of demographic trends may be.

IV. THE DETECTION OF CARRIERS OF "RECESSIVE" GENES

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THE SCIENCE OF HUMAN genetics has advanced rapidly during the past decade. Particularly significant and of interest to this audience is the world-wide, growing awareness by the medical profession of the etiologic role of heredity in disease and anomalous defects. This recognition of the importance of the genetic component in human disease has, furthermore, vastly stimulated and enlarged the scope of medical research, specifically in the fields of biochemistry and physiology. Improved medical methodology and instrumentation, coupled with increasing experience and knowledge on the part of the geneticist, have advanced our science to the point that we may now discuss such a subject as is here assigned to the authors, namely, the detection of the genetic carriers of inherited diseases.

A genetic carrier may be defined as an individual who possesses the potentialities of transmitting inherited disease while showing no or only a slight departure from normality. One of us (Neel, 1947) has previously classified the diseases in which a carrier state may be recognized into four chief categories:

1. Diseases dependent upon one or more nominally recessive genes, which are completely penetrant when homozygous but also show slight effects when heterozygous, *i.e.*, diseases dependent upon semi-dominant or incompletely recessive genes. Here the carrier is a heterozygote showing very minor effects of the gene; such carriers will never develop the disease in question.

2. Diseases in which individuals with the appropriate genotype do not develop the characteristic clinical findings until late adolescence, middle age, or even old age. In this instance the carrier is an individual who at first shows very minor effects of the gene; this same individual may gradually develop all the manifestations of the disease in question.

3. Diseases due to dominant genes of variable expression, in consequence of which affected individuals exhibiting only mild or minor effects of the "dominant" gene may produce progeny presenting a more serious form of the disease. Carriers falling into this category are individuals in whom a gene often responsible for a pathological trait fails to find full expression, presumably because of environmental and genetic modifiers.

4. Diseases having, at least in part, a genetic basis but for which the specific genetic mechanism is unknown, the carrier exhibiting clinically detectable departures from the norm, but which are relatively innocuous in character.

By assignment, this paper will consider only category one and thus will deal only with carrier states whose basis is genes exhibiting incomplete "recessiveness." Most of the more clearly defined carrier states thus far recognized fall into this category. However, the considerations which will be advanced concerning carrier states hold true for all four categories enumerated above.

It is obvious to this audience that the ability to recognize or detect carriers of "recessive" genes affords the physician invaluable data which particularly strengthen the accuracy of clinical diagnosis and prognosis. It is most important to realize that

the knowledge currently available regarding carrier states is far too meager to permit any but a preliminary report and one subject yearly to vast modification as well as amplification. Within the past few years it has become increasingly apparent that certain genes formerly believed to be completely recessive actually are detectable in the heterozygous state.

Table 1 presents an attempted summary of available information regarding "recessive" gene carrier states. The traits are arranged in alphabetical order. It must be emphasized that some carrier relationships so summarized are probably specific for a particular family or group of families and thus cannot be applied as a general relationship. This is so, for example, in the case of myopia (Yamazaki, 1927).

It is also to be emphasized that there is a wide disparity in the diseases entered in the table both in respect to the extent, validity, and usefulness of the observations concerning the existence of their carrier states. An attempt has been made to indicate the reliability and general applicability of the observations by a grading system of 1 through 4, where 1 indicates the best reliability. An arbitrary upper limit of three pertinent references or their equivalent (personal experience) for each disease has been adopted.

There are a very few diseases for which we can now predict with a high degree of accuracy just which marriages will result in affected children. Perhaps the outstanding example is the sickle cell disease of Negroes. By means of a simple and specific test it is possible to recognize with a very high degree of accuracy heterozygotes for the gene (with the sickle cell trait), and thus predict with considerable certainty which marriages can give rise to homozygous children with sickle cell disease. A second disease (or group of diseases) possibly on a par with sickle cell disease is sex-linked choroideremia, where apparently a very high proportion of heterozygous females exhibit characteristic retinal changes. Unfortunately, these are the exception. Thus, the most common designation of reliability appearing in Table 1 is "4." The actual occurrence of a carrier state for any disease designated by a "4" is dubious. It would be accurate to say for such diseases that there are hints as to the possible existence of a carrier state, but further work is indicated.

It will be noted that a relatively high proportion of the traits listed in Table 1 are sex-linked. To what extent this reflects the recognized prevalence of sex-linked traits in man as contrasted to most other mammals, and to what extent this is a consequence of the difference in the operation of selection on sex-linked and on autosomal recessive genes, is not now clear.

The practical implications for genetic counseling of the ability to detect the carriers of inherited disease are obvious. The extent to which, in the light of our present fragmentary knowledge, these implications should be pursued is debatable. More specifically, the data summarized in Table 1 are presented not with the thought of their immediate usefulness but more because of their theoretical implications. Thus, any attempt to evaluate selection in man rests upon the detailed knowledge of gene action implied in the recognition of carrier states. Furthermore, insight into primary gene action may in some instances proceed more readily from a study of minimally rather than maximally affected individuals.

It is noteworthy that the criteria for the recognition of carrier states at the present time are very largely morphological. It is well established that the ultimate basis of most if not all inherited disease is a biochemical aberration. As recognition of these basic biochemical defects proceeds, it may be anticipated that more carrier states will be recognized by biochemical tests, including biochemical stress tests deliberately designed to bring out subclinical metabolic deficiencies.

TABLE 1

"Recessively" Inherited Diseases for which Existence of a Recognizable Carrier State Amongst Heterozygous Individuals has been Suggested

Disease	*Mode of Inheritance*	*Characteristics of carrier state may be*	*Genetic relationship of carrier to manifest disease*	*Reliability*	*Reference*
Afibrinogenemia	a.r.	Fibrinogenopenia	As heterozygote to homozygote	2	Risak, 1935 Macfarlane, 1938 Schönholzer, 1939
Albinism (universal)	a.r.	Diaphanous irides to scleral transillumination	As heterozygote to homozygote	1	Waardenburg, 1947 Falls, 1953
Albinism confined to the eye	s.l.r.	Diaphanous irides to scleral transillumination. Female ophthalmoscopic appearance of scattered and isolated coarse cocoa brown islets of melanin pigment	Carrier females heterozygous for a gene for which the affected males are hemizygous	1	Waardenburg, 1947 Falls, 1953
Allergy (early, severe)	a.r.	Development of mild allergies sometime after puberty	As heterozygote to homozygote but only about 1-5 heterozygotes ever develop symptoms	4	Wiener, Zieve and Fries, 1936
Anhidrotic ectodermal dysplasia (sex-linked type)	s.l.r.	Very mildly affected females	Carrier females heterozygous for a gene for which affected males are hemizygous	3	Roberts, 1929 Levit, 1936
Anophthalmia	a.r.	Small eyeballs	As heterozygote to homozygote	4	Sorsby, 1934
Choroideremia	s.l.r.	Presence in females of same family of atypical and minor degenerative choroidoretinal changes	Carrier females heterozygous for a gene for which affected males are hemizygous	1	Goedblad, 1942 McCullough & McCullough, 1948 Sorsby *et al.*, 1952
Color anomaly	s.l.r.	Females with minor impairment of color vision	Carrier females are heterozygous for a gene for which affected males are hemizygous	3	Wieland, 1933 Schmidt, 1934 Pickford, 1949
Friedreich's ataxia	a.r.	Pes cavus and absent tendon and reflexes	As heterozygote to homozygote; findings in heterozygote inconstant	4	Davidenkov, 1940 Spillane, 1940
Hemophilia	s.l.r.	Females with minor prolongation of coagulation time	Carrier females are heterozygous for a gene for which affected males are hemizygous	3	Günder, 1938 Andreassen, 1943 Fonio, 1949
Juvenile amaurotic idiocy	a.r.	Various mental and neurologic stigmata. Increased incidence of vacuolated lymphocytes	As heterozygote to homozygote	3	Rayner, 1952
Keratoconus (recessive form)	a.r.	Split retinoscopic shadows and/or high degrees of astigmatism	As heterozygote to homozygote. Findings in heterozygote inconstant	3	Falls (personal observation) Sorsby, 1951
Keratosis follicularis spinulosa	s.l.r.	Females with mild keratosis follicularis	Carrier females are heterozygous for a gene for which males are hemizygous	1	Siemens, 1925 Galyon & Falls, unpublished
Laurence-Moon-Bardet-Biedl syndrome	a.r.	Obesity, skeletal abnormalities, atypical retinal changes	As heterozygote to homozygote, but carrier state changes of a very nonspecific nature	4	Sorsby, Avery and Cockayne, 1939

(Table 1 cont'd.)

Disease	*Mode of Inheritance*	*Characteristics of carrier state may be*	*Genetic relationship of carrier to manifest disease*	*Reliability*	*Reference*
Megalocornea	s.l.r.	Presence in females of same family of megalocornea	Carrier females are heterozygous for a gene for which males are hemizygous	4	Riddell, 1942
Morquio's disease	a.r.	Small stature and short midphalanges of hands and feet	As heterozygote to homozygote; relationship observed in only a single family	4	Grebe, 1943
Myopia, extreme	a.r.	Mild myopia	As heterozygote to homozygote	4	Yamazaki, 1927
Ophthalmoplegia, congenital	s.l.r.	Absence of deep tendon reflexes in lower extremities in females of same family	Carrier females are heterozygous for a gene for which males are hemizygous	4	Salleras and de'Zarate, 1950
Pelizaeus-Merzbacher disease	s.l.r.	Presence in females of same family of mild manifestations, chiefly nystagmus and optic atrophy	Carrier females heterozygous for a gene for which affected males are hemizygous. Relationship observed in only a single family	4	Siemens, 1925
Peroneal atrophy (sex-linked type)	s.l.r.	Mild and nonprogressive peroneal atrophy	Carrier females are heterozygous for a gene for which males are hemizygous—not all s.l. pedigrees exhibit this relationship	3	Raffan, 1907 Bell, 1935
Retinitis pigmentosa (choroidoretinal degeneration)	s.l.r.	Presence in females of same family of "tapetal-like reflex" ophthalmoscopic appearance	Carrier females heterozygous for a gene for which the affected males are hemizygous; not all pedigrees manifest this relationship	1	Falls & Cotterman, 1948 Sorsby, 1951 Wiener & Falls, unpublished
Rothmand's syndrome	a.r.	Atrophic dermatosis with telangiectasia	As heterozygote to homozygote	4	Thannhauser, 1945
Schizophrenia	a.r.	Schizoid personality	As heterozygote to homozygote	4	Rudin, 1916 Hoffmann, 1921 Strohmayer, 1925
Sex-linked hypochromic anemia	s.l.r.	Females with increased numbers of pale oval erythrocytes and/or splenomegaly	Carrier females are heterozygous for a gene for which affected males are hemizygous	1	Rundles & Falls, 1946
Sickle cell anemia	a.r.	Sickle cell trait	As heterozygote to homozygote	1	Neel, 1949
Thalassemia major	a.r.	Thalassemia minor	As heterozygote to homozygote	1	Gatto, 1942 Dameshek, 1943 Valentine & Neel, 1944
Werner's syndrome	a.r.	Canities, juvenile cataracts, and/or scleroderma-like skin changes	As heterozygote to homozygote; findings in heterozygote inconstant	2	Thannhauser, 1945
Xanthomatosis, extreme form	a.r.	Hypercholesterolemia	As heterozygote to homozygote	1	Fliegelman, Wilkinson, & Hand, 1949 Adlersburg, Parets & Boas, 1949
Xeroderma pigmentosa	s.l.r.	Excessive freckling	As heterozygote to homozygote	4	Siemens & Kohn, 1925 Cockayne, 1933

•a.r. autosomal "recessive" (incomplete recessive, semi-dominant, and so on)
s.l.r. sex-linked "recessive"

As knowledge of the genetic structure of human populations increases, it becomes increasingly apparent that each individual is heterozygous for a number of recessive genes with undesirable effects. In view of the number of recessively inherited pathologic traits already recognized, it is quite apparent that the development of the techniques appropriate to a precise evaluation of any individual's potentialities as regards the transmission of inherited disease constitutes an enormous task. In practical terms, the problem in carrier detection which will most often arise will be concerned with determining whether an individual from a family in which a given inherited disease occurs is a carrier of the recessive gene in question. The biological pitfalls inherent in genetic counseling which concentrate on the particular trait in question without an attempt to consider the genotype as a whole should be recognized. Otherwise stated, the day may soon come when by appropriate tests the average individual may actually be demonstrated to be the carrier of one or several recessive genes. This development will almost automatically force geneticists to a broader consideration of the genotype as a whole.

A few words might be said concerning the technical problems involved in the recognition of further carrier states. The logical point of departure is a search among the apparently normal members of a family in which a "recessive" disease occurs, aimed at the detection of minor manifestations of the disease in superficially normal individuals. It is essentially this type of investigation which brought to light carrier states such as have been suggested for afibrinogenemia and peroneal atrophy. The possibility must be constantly borne in mind, however, that the findings leading to the recognition of a carrier state may either represent one of the lesser manifestations of the disease or actually bear no apparent resemblance to the principal pathology. For instance, Rayner (1952), following up the earlier observation of Bugh and Hortling (1948) on the occurrence of vacuolated lymphocytes in persons with juvenile amaurotic idiocy, reports that heterozygotes for the gene in question also exhibit vacuolated lymphocytes. If this report is confirmed, then what is the most recently recognized, and certainly the most inconsequential, manifestations of the gene responsible for juvenile amaurotic idiocy becomes the clue to the carrier state. It is apparent that the foundation for the recognition of further carrier states—not to mention the validation of many of those mentioned in the table—is thorough family studies. Conversely, if in spite of the relatively little attention usually paid to the apparently normal members of a family in which genetically determined disease occurs, there are already this number of hints concerning recognizable carriers, it may be anticipated that systematic approaches to the problem should lead to the recognition of many more.

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V. TWIN STUDIES

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I

Modern science is interested in human twins for two fundamental reasons. First, twinning represents a biological phenomenon which is exceptional for the human species and is interesting in itself from several points of view: its frequency; its causes; the manner in which it occurs (embriogenesis); its characteristics (relative prematurity, anatomical similarity, etc.); its anomalies (double monstrosity, teratoma.)

As a biological phenomenon, the study of twins is pertinent to population problems in regard to the frequency and causes of twinning.

When this phenomenon is examined statistically, it is obvious that its frequency differs according to countries (see Table 1). The study of the frequency of twin births in countries where different races live together in the same environment has, furthermore, demonstrated that the phenomenon is substantially related to races (see Table 2).

With regard to the frequency of various types of twin births in a population, the so-called Law of Hellin may be recalled, which relates the frequency of higher twin births (triplets, quadruplets, quintuplets) to simple births. Hellin stated his law in the following way: "The higher the number of infants in a birth, the lower is the frequency of such births. If, on the average, a twin delivery in the human species occurs once for every 89 normal single deliveries, it is approximately true that a triplet delivery occurs once for every $(89)^2$ single deliveries, and quadruplet deliveries once for every $(89)^3$; hence it can be said that in general, and within the limits of probability, multiple deliveries of order x twins occurs in the ratio of 1 to $(89)^{x-1}$ single deliveries."

With regard to the cause of twin births, many research studies indicate that it is hereditary in nature. Table 3 reports the results of Gedda's and Capelli's studies of the families of 110 pairs of twins from

TABLE 1*

Denmark	1	twin	delivery	to	each	61.7	single	deliveries
Finland	1	"	"	"	"	67.9	"	"
Sweden	1	"	"	"	"	69.0	"	"
Italy	1	"	"	"	"	76.7	"	"
Scotland	1	"	"	"	"	78.0	"	"
Germany	1	"	"	"	"	81.6	"	"
Bulgaria	1	"	"	"	"	84.7	"	"
United States	1	"	"	"	"	84.0	"	"
Hungary	1	"	"	"	"	86.9	"	"
France	1	"	"	"	"	91.8	"	"
Australia	1	"	"	"	"	92.0	"	"
Uruguay	1	"	"	"	"	101.8	"	"
Spain	1	"	"	"	"	111.0	"	"

*International Institute of Statistics. L'Aja.

TABLE 2

COMPARISON OF THE FREQUENCY OF DELIVERIES IN WHITES AND IN NEGROES IN THE U. S. PER 100,000 BIRTHS

	Whites	Negroes
Single births	98,984.8	98,729.8
Total of plural births	1,015.2	1,270.2
Twin births	1,005.7	1,250.8
Births of triplets	9.2	19.2

*Vital Statistics, 1947, modified.

TABLE 3*

RESEARCH ON PRESENCE OF OTHER TWIN BIRTHS IN SIBSHIPS OF 110 PAIRS OF TWINS FROM ROME

Cases of twin births investigated		Presence of other cases of twin births in sibship		Negative or uncertain results		Cases of twin births in maternal pedigree only		Cases of twin births in paternal pedigree only		Cases of twin births in maternal and paternal pedigrees		Cases of twin births with unknown parentage	
	No.	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
MZ	51	41	80.4	10	19.6	18	43.9	13	31.7	8	19.5	2	4.87
DZ	59	44	74.57	15	25.42	25	56.81	9	20.45	5	11.36	5	11.36
Total	110	85	77.27	25	22.72	43	50.58	22	25.88	13	15.29	7	8.23

*Gedda and Capelli.

Rome, both identical (monozygotic, MZ) and non-identical (dizygotic, DZ). As a check, the families of 100 unselected school children from Rome were studied. Whereas in the first series there were 77 (27 per cent) pairs of twins among the siblings, they were represented in the second case by a frequency of 23 per cent.

This is a significant difference which demonstrates that a familial phenomenon is involved, that is, an hereditary characteristic. There are many hypotheses about the mechanism of the heredity concerned, and the problem must be regarded as unsolved. Therefore, we will limit our discussion to the one hypothesis, that of the "twinning factor" or the "factor G," which is held responsible for the hereditary predisposition to twin procreation. This does not prevent environmental factors from acting as a cause. With respect to the frequency of twin deliveries in families, it must be remembered that in a positive sense the frequency is ultimately influenced by a high family birth rate; in a negative sense by birth control and also by the fact that dizygotic twin pregnancies are more frequent in the second half of a woman's reproductive period.

Evidence that the "twinning factor" may play a qualitative as well as a quantitative role is found in the fact that both MZ twin births and DZ twin births can be found in many pedigrees, and the same is true of twin and higher order multiple births. (See Figs. 1 and 2)

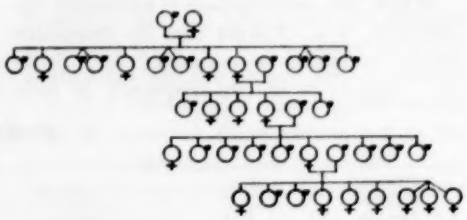

FIG. 1—Family tree with two pairs of twins and one triplet

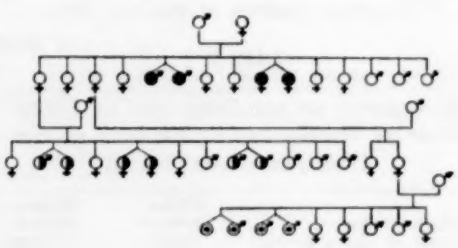

FIG. 2—Family tree with MZ and DZ pairs of twins

II

The second fundamental motive that urges science to concern itself with human twins is based on the fact that the study of twins represents an excellent method for solving problems pertaining not only to twins but also to the single-born and, consequently, to the whole human species. This second motive depends on the fact that MZ twins are considered equal from the hereditary point of view, and DZ twins can be considered equal from an environmental point of view, for they are unique in having a common residence in the maternal environment. For these reasons, twins offer an exceptional possibility for differential studies, based on intra-pair comparisons (between partners of the same pair) and on inter-pair comparisons (between groups MZ and DZ twins).

Hence, the twin research method can contribute to population studies dealing with those somatic and psychological traits which characterize a given population.

As far as somatic characteristics are concerned, the study of twins is applicable to normal as well as to pathological traits. The study of normal traits can be accomplished by intra-pair and inter-pair comparisons, and also by the use of MZ twins reared apart, or by the method of co-twin control, which subjects only one member of a pair to particular environmental changes and holds the other twin as a standard of comparison. In this way it can be determined to what degree heredity exerts an influence and to what degree environment does.

With regard to pathological traits, or diseases, that occur in a population under study, twin research offers many possibilities, such as the following:

1. *Discovery and confirmation of the hereditary nature of diseases* that repeat themselves in the same pedigrees. Here research work is usually carried out by intra-pair comparisons in a series of MZ twins and a series of unselected DZ twins, and by inter-pair comparisons of the results gathered in the two series; since hereditary traits are to a high degree concordant in pairs of MZ twins and relatively less concordant in DZ pairs, a statistically useful coefficient of concordance can be derived. This coefficient applies to dominant conditions and also to recessive (homozygous) conditions which are detectable in the heterozygous state.

2. *Discovery or confirmation of hereditary characteristics* related to susceptibility or abnormal responses to exogenous diseases (microbic, parasitic, occupational, traumatic, etc.). Therefore, in terms of the anatomical localization of a disease, the twin study method can be applied also in the study of exogenous pathology. The basis of evaluation is analogous to that indicated in (1); it consists in studying the characteristics that make for susceptibility (frequency of morbidity and mortality, serological and histological evidence of immunity, etc.), or for reactivity (clinical symptoms, course of the disease, response to therapy, type of outcome, etc.) to find out whether these characteristics are concordant or discordant in the two types of twins.

3. *Analysis of hereditary diseases* by means of Kallmann's "twin family method," which provides more information on the relationship between hereditary and non-hereditary components in a particular syndrome. This analysis involves the comparison of concordance with respect to these characteristics in a series of decreasing biological relationships consisting of the following combinations: (a) between MZ twins; (b) between DZ twins; (c) between single-born siblings; (d) between single-born half-siblings; (e) between persons coming from different parents but living in the same environment (stepbrothers, those of the same age and living together, etc.).

4. *Study of the expression of a hereditary disease.* In case of weak penetrance of the morbid genotype, the coefficient of con-

cordance described in (1) cannot be depended upon entirely, because a high degree of discordance can manifest itself even among MZ twins. If, however, the hereditary nature of such a disease is determined in another way, a low rate of concordance in MZ twins can serve to establish an important fact about gene expression, namely, incomplete penetrance of the disease in question. The twin method can also be used in studying the alternative precipitating causes of a disease in MZ twins who live in obviously different environments. Gedda holds that, *ceteris paribus*, a significant difference in the expression of a hereditary disease between members of an MZ pair is evidence for incomplete penetrance of the morbid genotype.

5. *Study of the variability of a hereditary disease.* The variability of a disease prevalent in a population can also be studied in terms of the reported degree of severity, or the different expressions of a disease as seen in the members of an MZ pair (for example, one twin may have a cleft lip and palate and the co-twin a simple dental anomaly).

6. *Improvement of nosological classification* in so far as different symptom complexes in MZ co-twins can be considered. (This is true in the case of one twin with hay fever and the other with a rash from sulfonamide drugs.) On the other hand, those diseases can be regarded as genotypically different which, though having some features in common, can never be found in the same pair of MZ twins, that is, one symptom in one twin, and the other in the second twin. (This is the case with manic-depressive psychosis and schizophrenia, which must be considered clearly distinct from each other because they have never been found in one MZ pair.)

III

As far as psychological characteristics of a population are concerned, twin research offers interesting possibilities in the following directions:

1. *Identification and study of instinctive tendencies and hereditary components of the mental functions* by applying the method of intra-pair and inter-pair comparisons and the "twin-family method" to the research that experimental psychology has carried out with regard to behavior, introspection, and projective tests. In this direction interesting qualitative orientations can be obtained by studying twins that have been raised separately and by studying the life histories of adult twins.

2. *Study of educability* (phenomena depending on the availability and methods of instruction; perception, association, memory, representation, attention, mental age, attitudes, etc.) by the *Co-twin control method* of Arnold Gesell, which gives one member of an MZ pair instruction and watches the co-twin simultaneously as a standard of comparison. In evaluating psychological findings, one must beware of erroneous conclusions based upon observations of behavior (e.g. left-handedness in one twin only).

3. *Identification and study of psychosomatic phenomena on a hereditary basis* (environmental characteristics, morbid reactions, necessity for emotional response) by the method of intra-pair and inter-pair comparisons.

IV

The kind of twin research referred to here must be conducted on a wide scale if it is to have a significance beyond that of individual case reports, and if it is to be applied in the systematic study of population phenomena.

A complete program should be planned so as to include the following:

1. A twin registry based upon lists kept in the offices where births are recorded;

2. A special noting of individual twins in the records of hospitals, institutions, insurance companies, doctors' offices, etc., with special indexing of twins in the cata-

logues of cases gathered;

3. Office and clinical facilities permitting medical examination of large numbers of twin pairs by standard and efficient methods. Probably also twin study deparments in institutes of human genetics and heredity clinics;

4. Establishment of twin study sections in schools of education and psychology in order to study the mental behavior of twins in relation to personality and educability of the population;

5. Initiation of social measures to favor twins, such as colonies for twins on the sea or in the mountains, social services, movies or theatrical performances especially reserved for twins, twin clubs where the well-to-do help the needy, libraries for twins, etc. In Italy several of these social measures have been promoted, and they have been found very useful in obtaining the cooperation of twins in medical and psychological studies.

VI. THE PATTERN OF BIRTH CONTROL IN PUERTO RICO

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In demographic terms, the trend of Puerto Rican fertility has not left room for great optimism. The crude birth rate of 40 characteristic of the past half century has been lowered only within the past two years and may only reflect the temporary breakup of families due to a large scale emigration. Various studies have indicated modest decrements in marital fertility, but these have been compensated for by earlier marriage. Combs and Davis in interpreting the lower age at marriage and the consequent increase of first order births hoped that it reflected a modern type response to economic conditions but feared, in the absence of wide-scale birth control practice, that it might only mean increased fertility. They suggest, in the light of the rapid modernization of the Commonwealth, that "family limitation sufficient to lower the birth rate substantially may be just around the corner."[1] It will be the function of this paper to explore some of the factors influential in sustaining high fertility, and to give some indication of the extent and effectiveness of birth control practice among different groups in the island's population.

Source of the Data

The Social Science Research Center of the University of Puerto Rico has for the past three years been engaged in studies of attitudes relevant to fertility and birth control. The total project can be divided into three phases:

1. An exploratory study involving intensive qualitative interviews with a small number of families.
2. A large scale, objective type interviewing study to verify or nullify hypotheses developed in Part 1.
   Part A: Brief screening interviews with a sample of 3000.
   Part B: Longer interviews with a sub-sample of 1200.
3. A series of controlled experiments designed to test the conclusions of Phases 1 and 2 by employing various techniques of persuasion on selected groups in the population.

Field work has been completed for parts 1 and 2, and analysis has been completed for Parts 1 and 2A. The present paper will lean chiefly on the latter for its data, describing the other phases briefly in subsequent sections.

Phase 2A, conducted by Reuben Hill and the writer, secured information on the knowledge and use of birth control of 3000 Puerto Ricans. A five-to-ten-minute interview was conducted with men and women meeting the criteria of married (or mated) and fertile (at least one pregnancy) who entered nine of the island's public health centers between August and October of 1953. These centers give free medical care of practically all types to any individual desiring it. Table 1 compares several characteristics of the sample group with the total population.

TABLE 1

AGE, EDUCATION, FERTILITY AND RESIDENCE

	Sample	1950 *Census*
Median Age	29.8	33.8
Median Education	4.2	4.1
Median Live Births	4.2	4.1
Per Cent Urban	37	40

The sample draws a somewhat younger group probably because interviewers tended

[1] "The Pattern of Puerto Rican Fertility," *Population Studies*, March, 1951, p. 379.

TABLE 2

MEDIAN PREGNANCIES IN PRESENT UNION, BY AGE, RESIDENCE AND EDUCATION

Age	Less than 25		25–34		35	
Residence	Urban	Rural	Urban	Rural	Urban	Rural
No Education	2.8 (22)	2.8 (61)	5.6 (43)	6.0 (113)	7.1 (80)	9.0 (175)
1–3 yrs.	3.2 (54)	2.8 (143)	5.3 (101)	5.6 (242)	7.0 (109)	8.9 (235)
4–5 yrs.	3.2 (66)	2.9 (137)	4.9 (115)	5.0 (228)	6.3 (92)	8.6 (190)
6 yrs.	2.6 (144)	2.6 (141)	4.1 (145)	4.5 (142)	5.7 (68)	6.8 (66)

not to select cases who appeared "too old." Consequently, whereas close to 9 per cent of the total population of married women is 55 years of age or more, less than 1 per cent of our sample falls in this category. Moreover, while the medians for education are identical, the sample has a dearth of cases in the extreme groups—no education and high school education—probably because these two groups are less likely to take advantage of free facilities. However, in general, the sample corresponds fairly well to the general population, although the possible bias involved in dealing with a "health-oriented" population cannot be determined.

Differential Fertility

Let us first see to what extent the members of the sample evidence differential fertility.[2]

In the youngest age group education and residence appear to bear little relation to fertility, perhaps indicating that in all groups family limitation is not initiated early in marriage. This is in accord with Hatt's attitude data which shows that well over half the population, with little difference by education or economic level, believe that the first child should come as soon as possible,[3] and with our own qualitative data indicating that many women desire to get childbearing over with as soon as possible. However, as age increases, the differences in fertility increase, both education and residence appearing influential. Maximum fertility is achieved by the rural respondents of no education, and minimum fertility by the urban well educated.

Since these factors are of such importance, a brief examination of the trends in education and residence for Puerto Rico would seem relevant. Table 3 shows that the island has been moving steadily toward those factors associated with low fertility.

TABLE 3

RESIDENCE AND LITERACY IN PUERTO RICO, 1910–1950 (SOURCE: U. S. CENSUS REPORTS)

	% Urban	*% Literate*
1910	23	33.5
1920	27	45.0
1930	28	59.6
1940	30	68.5
1950	40	75.7

The Practice of Birth Control

Differential fertility is normally the product of differential use of birth control, but we do not usually associate Puerto Rico with birth control. Actually a good deal of family limitation is practiced. In the present sample, despite Catholicism, low average education, and youthfulness, 53 per cent

[2]For evidences of differential fertility in the total population see J. W. Combs and K. Davis, "Differential Fertility in Puerto Rico," *Population Studies*, Nov., 1951; and Paul Hatt, *Backgrounds of Human Fertility in Puerto Rico* (Princeton: Princeton University Press, 1952) Chapter VI.

[3]Hatt, *op. cit.*, Tables 154 and 155, pp. 186-7.

have at some time in their marriages practiced some form of birth control, and 37 per cent are currently using a method. A third of the sample has used or is using mechanical or chemical methods, a fifth have used or are using natural methods and a fifth are sterilized.[4]

Education, which was seen to be such an important correlate of fertility, shows a similar relation to birth control use. Forty-three per cent of those with no education and 60 per cent of those with six years or more of education have used birth control. Only a slight difference is shown by residence, but the combination of residence and education indicates that the latter has a greater impact on urban respondents.

TABLE 4

PER CENT WHO HAVE EVER USED A BIRTH CONTROL METHOD BY EDUCATION AND AGE

Age	*No. Ed.*	*1–3 Yrs.*	*4–5 Yrs.*	*6 Yrs.*
15–24	40	38	41	47
25–34	54	56	58	69
35	38	50	61	70

Since education is strongly correlated with age in Puerto Rico, Table 4 shows the effect of education when age is held constant.

In general the middle age group is the one most likely to have practiced birth control. This is not surprising, since they are more or less of the younger generation which is less conservative and has had more birth control materials available. Moreover, unlike the younger group, they are experiencing considerable fertility pressure. By and large, education continues to affect birth control use regardless of age, but its impact is most striking among the older groups. For younger individuals who have not yet felt the pressure of fertility, education makes relatively little difference. Thus, if an individual is well educated, once he feels the pinch of numbers on resources, he is much more likely to act than is the individual of the same age but with little education.

The Effectiveness of Birth Control

While the extent of birth control practice is of course important, the vital question is how effectively the methods are used. Table 5 gives some indication of the effectiveness of various categories of contraceptors.

TABLE 5

MEDIAN PREGNANCIES IN CURRENT UNION BY BIRTH CONTROL USE

	Married Less Than 10 Yrs.	*Married 10 Yrs. or More*	*No. of Cases*
Current users, modern methods*	2.9	7.4	(293)
Current users, "natural" methods*	2.9	7.2	(195)
Past users, modern methods	3.8	7.9	(354)
Past users, "natural" methods	3.0	7.4	(91)
Sterilized, past birth control experience	3.7	6.5	(297)
Sterilized only	3.5	6.7	(315)
Never used birth control	2.8	8.1	(1404)

*Modern methods refer to the usual chemical mechanical techniques; "natural" methods to withdrawal and rhythm, the latter representing a very small proportion of the "natural" category. Where combinations of "natural" and modern occur, they are included in the latter category.

[4]No other recent data on the frequency of birth control use is available. In 1947, Hatt reported that 6.6 per cent of a representative sample of the island's women were sterilized. However, the rate of sterilization in the past five years has probably increased considerably. More important, it is felt that Hatt's interviewing methods were not such as to elicit maximum reliability of response on this subject. In our sample, 500 interviews conducted by nurses rather than trained interviewers showed a much lower proportion of knowledge and use of birth control, indicating the importance of careful interviewing. For more detailed considerations of sterilization, see Hatt, *op. cit.*, pp. 443-452; and J. Mayone Stycos, "Female Sterilization in Puerto Rico," *Eugenics Quarterly*, June 1954, pp. 3-9.

Several points should be noted: (1) The fertility of the never users is not so different from the users as might be expected. In the earlier marriage period their fertility is extremely low, and in the older group, the difference in pregnancies between current users of modern methods and non-users is only 0.7. This may be partly due to the fact that individuals with lower fertility feel less need to practice birth control. Moreover, even within the two length of marriage groups, they tend toward the lower age limits. (2) Current contraceptive users have only slightly lower fertility than past users. (3) Current users of modern methods have the same fertility as users of "natural" methods. In the past users group, their fertility is even higher. (4) Sterilization, while the most effective method,[5] is undergone too late to be of maximum effectiveness. (Thirty-eight per cent were sterilized after at least six pregnancies. The mean number of children borne by completion of childbearing is six for the total population).

The main conclusion to be reached from the foregoing would seem to be that despite widespread practice of birth control, the methods are used so late or so ineffectively that their effect on fertility is minimal. Among which groups in the sample is birth control most ineffective and what accounts for this ineffectiveness? Table 6 answers the first part of this question.

Table 6 shows that in general the better educated are more successful as regards birth control. They appear to have their sterilizations at an earlier date than the less educated and practice birth control somewhat more effectively. Among the more recently married, residence appears to make little difference in effectiveness, but in the older group urban cases appear to practice birth control with considerably more effectiveness.

The explanation for the erratic and short-lived utilization of birth control methods appears to have little to do with availability of materials. Seventy-six Public Health Units and as many sub-units are scattered over the small island and offer weekly pre-maternal clinics where free advice and materials are supplied. A fair number of women attend these clinics, but many never return to replenish their supplies.[6]

A possible explanation both for non-use

TABLE 6

MEDIAN PREGNANCIES IN CURRENT UNION BY BIRTH CONTROL TYPE, EDUCATION, RESIDENCE AND LENGTH OF MARRIAGE

		Sterilized				*Other Birth Control*			
		Lo Ed.		Hi Ed.		Lo Ed.		Hi Ed.	
		Md.	N.	Md.	N.	Md.	N.	Md.	N.
Married 0–9 Yrs.	Urban	4.2	(17)	3.6	(77)	3.5	(61)	3.1	(131)
	Rural	3.8	(55)	3.5	(84)	3.3	(108)	2.9	(163)
Married 10–19 Yrs.	Urban	6.3	(32)	5.1	(65)	6.5	(50)	6.4	(66)
	Rural	7.0	(85)	5.8	(92)	7.5	(116)	6.7	(96)
Married 20 Yrs.*		9.8	(50)	9.4	(39)	11.0	(77)	9.6	(59)

*Insufficient cases to divide by residence.

[5]Sterilizers have an unexpectedly high number of pregnancies in the "less than ten years married" group because of a bunching toward the end of this period. For each five year period of marriage except the first, they show fewer pregnancies than the other groups.

[6]In 1945 these clinics distributed, among other methods, about 40,000 dozens of condoms. By 1950 the figure had increased by only 7000. In 1950, the clinics showed a case load of 22,000, but in that year alone, 6300 cases dropped out of the clinics. (Department of Health Annual Reports.)

and ineffective use of birth control would be ignorance of methods. In terms of sheer awareness of the existence of various techniques of contraception, however, the present sample leaves little to be desired. Only 6 per cent said they had never heard of a birth control method, and even this estimate is probably too high (see footnote 4). Nine out of ten know sterilization, nine out of ten know at least one mechanical or chemical method, and six out of ten know withdrawal. As might be expected, a higher proportion of ignorance is found with the rural, the poorly educated, and the young.

A more serious drawback, especially as regards the effectiveness of birth control, concerns the time of inception of knowledge. In a culture where women are sheltered before marriage, and where discussion of sexual matters is generally taboo, even husbands and wives are reluctant to discuss birth control methods.[7] Consequently, women tend to learn about birth control methods relatively late in marriage. In a sub-sample of 890 wives and 320 husbands (drawn from Phase 2B), 60 per cent of all methods known by the wives were learned sometime subsequent to the third pregnancy. Only 8 per cent were known before marriage. In the case of the males, 50 per cent of all methods known were known prior to marriage. The methods which would be of greatest use early in marriage are the ones learned latest. For example, sterilization is learned early, 22 per cent knowing this method prior to marriage, but other methods are learned much later.

Another important deterrent to use and effective use would be lack of motivation to practice family limitation, or adverse attitudes toward the methods themselves. In terms of ideal family size, there is little question that the average mother is in favor of the small family. Seventy-three per cent of the women in our sample and 80 per cent of the women in Hatt's sample gave their ideal family size as three or less. Moreover, both Hatt's study and our own indicate that religious objections are minimal. There are, however, many other objections to birth control which make its adoption difficult and its practice short-lived.[8]

For the Future

At the Social Science Research Center we hope to be able to throw more light on the psychological and social factors associated with fertility. In Phase 2B, we have, along with more precise measures of fertility and birth control, more ample and precise data on such psychological and social factors. Traditionalism, levels of aspiration, modesty, family size ideals, and concern for virility are some of the psychological variables we are working with. Our data on interpersonal relations focus on matters such as communication between spouses, marital adjustment, and empathy. The influence of reference groups on knowledge and attitudes with respect to family size and family limitation is also being analyzed.

For the present, our information is probably sufficient to make a few generalizations and predictions. (1) An interest in the small family is characteristic of all socioeconomic and residence classes in the population. (2) Birth control is attempted by a large proportion of all groups in the society, though to a greater extent by the

[7]The subject of communication between spouses is given fuller treatment in another paper at these meetings. Stycos, Back & Hill "Problems of Communication between Husband & Wife on Matters Relating to Family Limitations" World Population Conference. See also references in footnote 8.

[8]The documentation for the remarks which follow stems from Phase 1 of the project, in which intensive interviews were conducted with the husbands and wives of 72 lower class families. Detailed analysis of these interviews is provided in the writer's forthcoming volume, *Family and Fertility in Puerto Rico*. For briefer statements see, "La Dinámica del Control de la Natalidad en la Clase Baja de Puerto Rico," *Revista Mexicana de Sociología*, Vol. XV, No. 1, 1953; and, (with Reuben Hill) "The Prospects of Birth Control in Puerto Rico," *Annals of the American Academy of Political and Social Science*, Jan., 1953.

better educated. (3) A low degree of success is achieved, particularly by rural, poorly educated groups. (4) A great number of objections to birth control based on faulty or insufficient information are among the deterrents to the effective practice of family limitation.

There is every indication that only a fair-sized push would make users out of non-users and effective users out of non-effective ones. A natural push is occurring gradually by means of increasing urbanization, education and secularization of values. An island-wide educational program would doubtless accelerate the fertility decline. But with or without a program it is a good bet that the "birth control corner" which Combs and Davis speculate about is not far off. Whether it is close enough to save the island's families the anguish of having too many children for their as yet slim resources is another question.

SCANDINAVIAN FAMILY ALLOWANCES
Demographic Aspects

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THE SCANDINAVIAN COUNTRIES have led in democratic population policies as in so many fields of social welfare legislation. During the last ten or fifteen years these countries have implemented a number of measures designed to improve the welfare of families with children and equalize the levels of living of such families with that of childless families. Particularly in Sweden a comprehensive scheme of legislative measures has been introduced based upon the findings of numerous studies of demographic trends and their implications, the economic and social conditions of the family, and the needs of mothers and children. The purpose of the present article is to describe the aim and principal features of Scandinavian family-welfare policies; to indicate the nature and magnitude of assistance provided by one of the chief measures, namely, family allowances; and to test the effects, if any, of this measure upon the trend in fertility.

Purpose of Scandinavian Population Policies

The emergence of population policies in the Scandinavian countries can be attributed to a great extent to the growing concern about the decline in the birth rate in these countries in the 1920's and 1930's. In 1934 the net reproduction rate in Sweden and Norway was only 0.74 (*i.e.*, reproduction would in the long run only be 74 per cent of replacement if the existing level of fertility and mortality continued to prevail). This was even below the level of reproduction in France, a country which for decades had been concerned with the threat of a declining population. Therefore, governmental commissions were created in both Sweden and Denmark to study the population problems and make recommendations for legislative measures. The findings of the Swedish Commission, in particular, has influenced public opinion not merely in Sweden but also in the neighboring countries. The commission held that married couples had come to limiting excessively the size of the family particularly because of the economic burden of childbearing and childrearing. It was believed that once the community assumed the responsibility for a substantial part of the costs of children married couples would be inclined to have more children.

Despite the fears which had arisen in Scandinavia concerning possible depopulation, a narrowly defined pro-natalist policy was never advocated in these countries. The prevailing opinion has always been that a population policy should be formulated in accordance with democratic traditions and that little would be achieved by propaganda or by measures merely aimed at increasing the size of families. Therefore, in implementing measures of population policies, the aim has been not merely to counteract a trend toward depopulation but also to contribute to better living conditions for families with children.

This approach is in line with the social-welfare policy which aims to secure a minimum level of living for all families. Further, the general feeling of social justice supports a policy of redistribution of income and wealth in favor of families with

children, in particular, those with many children. As the birth rate recovered in the 1940's and the threat of a declining population disappeared—at least for the near future—demographic considerations were naturally relegated somewhat to the background when the major part of the program was implemented.

Principal Measures

Some examples will be given here of recent legislative measures in Scandinavia with an indication of the importance of demographic considerations in formulating them. Unlike the pro-natalist policies of certain countries such as France, no attempts have been made to suppress information on contraceptive practices or to limit such practices. On the contrary, information on the use of contraceptives is provided among other services at many state and municipal maternity health centers, and in Sweden pharmacists are required by law to sell contraceptive items.

As far as abortion is concerned, rather little importance is given to fighting induced abortions by prosecution and severe punishment. Efforts are being concentrated on eliminating as far as possible the economic and social reasons which cause women to seek abortions. Thus, in all Scandinavian countries economic assistance is provided for expectant mothers, expenses for confinement services are low or non-existent, and centers have been established where expectant mothers can obtain advice and aid of various kinds. Of psychological importance is a Swedish law which prohibits the dismissal of a woman employee for reasons of pregnancy or childbirth. In addition, in all Scandinavian countries induced abortions can be performed legally where it can be demonstrated that childbirth constitutes a grave risk to the life or health of the mother. In Sweden and Denmark induced abortion may also be performed if justified on eugenic and criminal grounds or according to certain socio-medical considerations.

The philosophy behind this policy is that the community is not primarily interested in more children but in desired children. Further, recourse to illegal abortions performed by unqualified persons constitutes a far greater danger to the life, health, and fecundity of women than does abortion performed by properly authorized medical authorities.

As far as economic aid to the family is concerned, the notion of outright cash allowances was not favored in the earlier family welfare programs. It was felt that even if cash allowances might be more immediately effective in encouraging larger families, measures for equalizing the economic burden of childbearing and childrearing should preferably be given in the form of help in kind to make certain that mothers and children would benefit fully from them. However, this rather unqualified preference for help in kind has been abandoned in recent years when the major part of family welfare measures was implemented. The principal opinion has been that for each segment of, and for each specific need in, the program, the most suitable form of assistance should be chosen and no over-all principle for or against help in cash should be applied.

As a result, a number of provisions covering benefits to families with children have been introduced or expanded to cover some of the needs of the family such as pre-natal and post-natal services, confinement services, economic and social and medical aid to the mother, daytime child welfare institutions, holiday travel for mothers and children, school meals, marriage loans, rent rebates and home-help services. However, at the same time it was realized that such assistance did not relieve the families of the economic burden of the costs of children to the extent which was considered desirable. Therefore, family allowances have been introduced as well, and today this is the basic scheme of equalizing the costs of children.

Nature and Magnitude of Family Allowances

Family allowances were introduced in all Scandinavian countries around 1947–50. The most comprehensive scheme is found in Sweden where all mothers receive a family allowance amounting to Kr. 290 annually for each child under 16 years of age. In Norway no allowances are granted for the first child in a family, but Kr. 240 annually is allowed for the second child, and Kr. 340 for each child thereafter. In Denmark, allowances amounting to Kr. 182 in Copenhagen and slightly less in provincial towns and rural areas are allotted for each child in low-income families. As the income of the family increases, the amount of the allowances is reduced according to a sliding scale.

Any discussion of the extent to which the family has been reimbursed for the economic costs of children would be incomplete without consideration of the tax deductions allowed for children. For many years the burden of childhood dependency has been somewhat reduced by allowing the families to make certain deductions in tax assessments on account of dependent children. However, as the income tax structure has become increasingly progressive, the deductions from gross taxable income allowed for each child have resulted in a system in which the net benefits of the deductions for the higher income families are far greater than for the middle income families, and the majority of low income families obtain no benefits at all as they pay little, if any, income tax. Therefore, tax relief in favor of dependent children was not an appropriate way to obtain the extent of equalization of the costs of rearing children desired.

In Sweden, the deficiency of the existing system of tax assessments was fully realized, and as a consequence deductions in taxable income on account of children were discontinued and family allowances were introduced at a rate equal for all. The great majority of the families with children, and low income families in particular, gained substantially by the new scheme. In Norway and Denmark a combined system of family allowances and tax assessment in favor of families with children is in existence. The general idea underlying the Danish scheme of family allowances graduated by income was to make up for the stated deficiency in the system of tax assessment and to secure, as far as possible, the same total benefit of the combined scheme to all families. However, this has only been accomplished to a limited extent, and the well-to-do families still receive substantially higher total benefits than do low income families.

The extent to which family allowances and tax relief have reduced the economic burden of children depends of course upon the standard of living of the individual family. However, some indication may be obtained from the following example: On the basis of recent inquiries in Sweden and Norway on the extra costs of maintaining a child without reducing the standard of living, it is estimated that, for a family with three children aged 4, 7 and 10 years and the average income for industrial workers in urban areas, the family allowances cover 25 to 30 per cent of the "costs" of maintaining the children in Sweden; in Norway the family allowances and the tax relief combined cover 30 to 35 per cent of the costs. The proportion of extra costs of children covered by these schemes is generally higher in rural areas where the expenses of children for food and housing are somewhat lower.

Other measures than family allowances and tax relief are important for reducing the economic strain of children. For example, free school lunches are provided to all children in most urban areas and in certain rural areas in Sweden; in Denmark and Norway children in many urban areas are benefited by such programs. Moreover, considerable rent assistance is granted fam-

ilies with at least two children who live in dwellings constructed in recent years which meet certain minimum standards. Thus in Sweden such families receive an annual rent grant amounting to Kr. 150 annually for each child and a fuel grant of Kr. 150–300 for each family. Further, families with low incomes obtain additional allowances of Kr. 210. In Denmark the allowances amount to 10 to 20 per cent of the actual rent, varying from Kr. 100 to Kr. 250 for each child, and in Norway such allowances are between Kr. 30 and Kr. 120. However, since rent allowances are granted only to those families living in housing constructed during the last 10 or 15 years, these benefits are limited in scope, so far, and mainly applicable to families in urban areas.

Effects on Fertility

Even if the Scandinavian program of family allowances and other economic measures in favor of the family is not based solely or mainly upon demographic considerations, it is interesting to see whether this program can claim any effect upon the birth rate. This task is a difficult one for various reasons. The program was implemented over a span of years and is still in the process of being expanded; therefore, any demographic effect it may have had would be asserted gradually and is likely to be hidden by other factors in action at the same time. Further, some of the most important measures were introduced only recently, and the demographic data available for an analysis of the effects, if any, are necessarily rather limited for the time being. In spite of these difficulties, an attempt will be made here to determine whether there is any evidence of effects upon fertility. The discussion here will be limited to family allowances, an important measure which can be related to a specific time period.

For such analysis, it is necessary to outline the trend in the birth rate and its most important components. The recent trend in the birth rate in the Scandinavian countries is very similar to that found in the majority of other European countries, namely, a recovery of the birth rate during the Second World War and the early postwar period, followed by a decline in most recent years. The rise in the birth rate reached its peak in Sweden and Denmark in 1944, but in Norway the increase continued until 1946. As shown in Table 1, the decline which followed has been rather steady, but stabilization seems to have been achieved since 1951.

TABLE 1

BIRTH RATES (PER 1000 POPULATION) IN SCANDINAVIA, 1930–52

	Sweden	Norway	Denmark
1930–34	14.4	15.7	17.9
1935–39	14.5	15.0	17.9
1940–44	17.7	17.7	20.3
1945	20.4	20.0	23.5
1946	19.7	22.6	23.4
1947	18.9	21.4	22.1
1948	18.4	20.5	20.3
1149	17.4	19.5	18.9
1149	17.4	19.5	18.6
1951	15.6	18.4	17.8
1952	15.5	18.7	17.8

A major part of the rise in the birth rate in the early 1940's was due to an increase in the number of marriages. In recent years the marriage rate has begun a new downward trend. Thus, in Sweden it declined from 9.9 per 1000 in 1944 to 7.4 in 1952 and in Norway from 9.5 in 1946 to 8.2 in 1952 and in Denmark from 9.8 in 1946 to 8.2 in 1952. The question arises, then, whether the fall in the birth rate in recent years is mainly due to the decline in the marriage rate or whether marital fertility itself has decreased.

As fertility of married women is highest early in marriage and falls with increased marriage duration, a decline in the number of marriages will tend to reduce the number of births during the next few years; an increase in the number of marriages will tend to have the opposite effect. Therefore, to make allowance for the effects of changes in the number of marriages, the

TABLE 2

NUMBER OF CONFINEMENTS BY DURATION OF MARRIAGE PER 100 MARRIED WOMEN, SWEDEN 1939–50

	Duration of Marriage (in years)													
Year	Under 1 yr.	1–2	2–3	3–4	4–5	5–6	6–7	7–8	8–9	9–10	10–11	11–15	15 yrs. & over	All married women
1939	32.0	19.8	17.1	15.4	13.3	12.3	10.9	9.5	8.3	7.4	6.6	20.5	15.0	188.1
1940	33.2	18.8	16.6	14.2	12.5	11.0	9.8	9.0	8.1	6.9	6.3	19.1	13.8	179.3
1941	32.5	21.2	16.8	15.1	13.3	11.5	10.1	9.0	8.0	7.0	6.2	19.1	14.4	184.2
1942	35.0	21.3	20.2	17.2	16.1	14.1	12.5	10.7	9.5	8.3	7.4	21.5	15.2	209.0
1943	37.6	23.9	19.7	19.5	16.5	15.0	13.5	12.3	10.4	9.0	8.2	23.5	15.6	224.7
1944	40.1	24.4	21.1	18.5	18.2	15.2	14.3	12.5	11.2	9.6	8.5	25.2	16.5	235.3
1945	40.6	23.7	20.7	18.3	16.2	15.7	13.1	12.0	10.6	9.4	8.2	24.5	16.0	229.0
1946	40.8	22.4	19.9	18.0	16.2	14.2	13.3	11.3	9.9	8.8	8.0	22.6	14.9	220.3
1947	41.7	23.1	19.4	17.2	15.6	13.4	11.5	11.0	9.0	8.3	7.2	21.1	14.5	213.0
1948	41.8	23.4	19.1	16.9	15.2	13.7	11.7	9.8	9.4	7.6	6.9	20.2	14.3	210.0
1949	40.8	23.1	18.7	16.9	14.8	13.1	11.6	9.8	8.1	7.7	6.3	18.5	13.1	202.5
1950	40.9	21.3	18.4	16.2	14.5	12.6	10.6	9.3	8.1	6.8	6.2	16.8	11.4	193.1

composition of existing marriages by duration of marriage has to be taken into account. For Sweden data are available on the annual number of births by duration of marriage and the number of married women of various durations of marriage. Table 2 presents for the years 1939–50 the average number of confinements[1] per 100 married women at various durations of marriage. The sum of these duration-specific fertility rates for a given calendar year provides a measure of marital fertility of that year standardized for the effects of variations in the annual number of marriages over the last 25–30 years or more.

Similar data cannot be presented for Norway, as no year-by-year estimates are available on the number of women at various durations of marriage. However, approximately the same results can be obtained by relating the number of births to women at various durations to the number of marriages contracted in the year they were married. In Table 3 such rates are given per 100 marriages. It is obvious that the rates computed in this way will, *ceteris paribus*, tend to be somewhat lower than the true duration-specific rates as no allowance is made for the fact that the number of existing marriages in cohorts of married women is gradually reduced by divorce and death. However, this factor is of only minor importance here as we are mainly concerned with the earlier years of marriage. Further, the divorce rates and mortality rates are rather low in Norway and do not change fundamentally from year to year. A direct comparison between the level of the fertility rates for the two countries should not be made (the rates for *all* women for Norway are too low by approximately 10 to 20 per 100 marriages), but in the present paper the main purpose is to study the recent trend in marital fertility within each country. Duration-specific fertility data for Denmark are not presented here as no data are available yet for the years following 1950 when family allowances were introduced in that country.

The annual sums of fertility rates specific for duration show that the recent decline in the birth rate is not just a corollary of a decreasing number of marriages. Similar to the trend in the crude birth rate, marital fertility expressed as the average number of births per marriage reached its peak in Sweden in 1944 and in Norway in 1946,

[1]Contrary to the Norwegian statistics, the Swedish data are given by confinements instead of by live births.

TABLE 3

NUMBER OF BIRTHS BY DURATION OF MARRIAGE PER 100 MARRIAGES, NORWAY 1939–50

Year	*Duration of Marriage* (in years)[1]													
	Under ½ yr.	½–1½	1½–2½	2½–3½	3½–4½	4½–5½	5½–6½	6½–7½	7½–8½	8½–9½	9½–10½	10½–14½	14½ yrs. & over	All married women
1939	18.7	32.8	21.9	18.2	16.5	14.7	12.6	11.2	9.6	8.2	7.4	22.1	16.9	210.8
1940	18.4	32.2	21.9	17.7	15.9	14.2	12.7	10.5	9.8	8.1	7.2	21.1	16.9	206.6
1941	18.8	31.0	20.4	15.9	13.7	12.0	10.6	8.8	8.0	7.3	6.5	18.8	16.1	187.9
1942[2]	19.9	38.4	26.0	19.5	16.0	14.3	12.8	9.3	8.0	6.4	5.6	16.4	11.5	204.2
1943[2]	21.7	38.0	26.2	22.4	18.1	15.5	13.7	11.7	9.0	7.3	6.2	17.5	11.6	219.0
1944[2]	23.0	44.2	27.9	25.6	23.2	20.2	16.8	14.4	12.7	9.5	8.2	21.3	14.5	261.1
1945	22.5	39.8	22.2	20.6	17.6	16.7	15.1	13.5	11.7	10.4	9.8	26.8	19.1	245.8
1946	20.6	42.4	26.2	22.0	21.7	19.2	19.1	16.2	14.7	13.0	11.9	31.7	22.5	281.2
1947	21.2	39.3	26.1	20.9	19.5	17.7	15.7	14.4	12.3	11.5	10.3	28.3	21.3	258.5
1948	20.4	38.0	23.8	21.5	19.4	16.1	15.4	13.1	11.9	10.4	9.1	26.0	19.9	245.0
1949	20.2	36.7	23.2	19.4	19.7	17.1	14.0	12.4	10.8	9.7	8.1	23.8	18.1	233.2
1950	20.0	38.2	23.0	19.4	17.8	17.5	14.6	11.5	10.8	9.2	8.1	22.3	15.1	229.3

[1]Whereas in the Swedish fertility statistics, duration of marriage is stated in completed years of marriage, the Norwegian data are tabulated by year of marriage (it is assumed that marriages taking place in a given calendar year have an average duration of marriage of ½ a year by the end of that year, of 1½ years by the end of the following year etc).

[2]Births by duration of marriage not available for these years. Estimates were made on the basis of the annual number of births by order and the duration—parity—specific rates calculated for 1940 and 1945.

and has declined since then. In the case of Sweden marital fertility declined by about 18 per cent whereas the birth rate declined by about 25 per cent in the period 1944–50. In Norway, however, where the fall in the marriage rate has been much smaller and started somewhat later, the decline was around 18 per cent for both in the period 1946–50. Therefore, a considerable part of the decline in the birth rate in Sweden in recent years and most of that in Norway was due to a tendency toward lower fertility among persons married. There is no evidence of any appreciable change in the course of marital fertility due to the introduction of family allowances in Sweden early in 1948 and in Norway late in 1946.

A somewhat more complete analysis of the recent trend in marital fertility can be made by studying the annual growth in family size for women at various durations of marriage. For this purpose the fertility rates given in Tables 2 and 3 are accumulated for each cohort duration by duration (along the diagnonals in the tables) and presented in Charts 1 and 2.

It would be expected that favorable effects, if any, of family allowances would show up within a few years. Couples married for some years might expand their family size, with little delay, beyond that planned before family allowances were introduced; those married recently would tend to reduce the spacing of their children. However, no such "shock effect" appears to have materialized.

In Norway, the family size is lower in all post-war marriages than in 1941–45 cohorts at similar durations, in spite of the fact that economic conditions were more favorable in recent years than during and immediately after the war. The recent trend in the average family size at high durations is complicated by the fact that many of the cohorts at these durations in the post-war years are composed of women married in the years before and immediately after the outbreak of the war. These women avoided maternity to a considerable extent during the earlier years of their marriages because

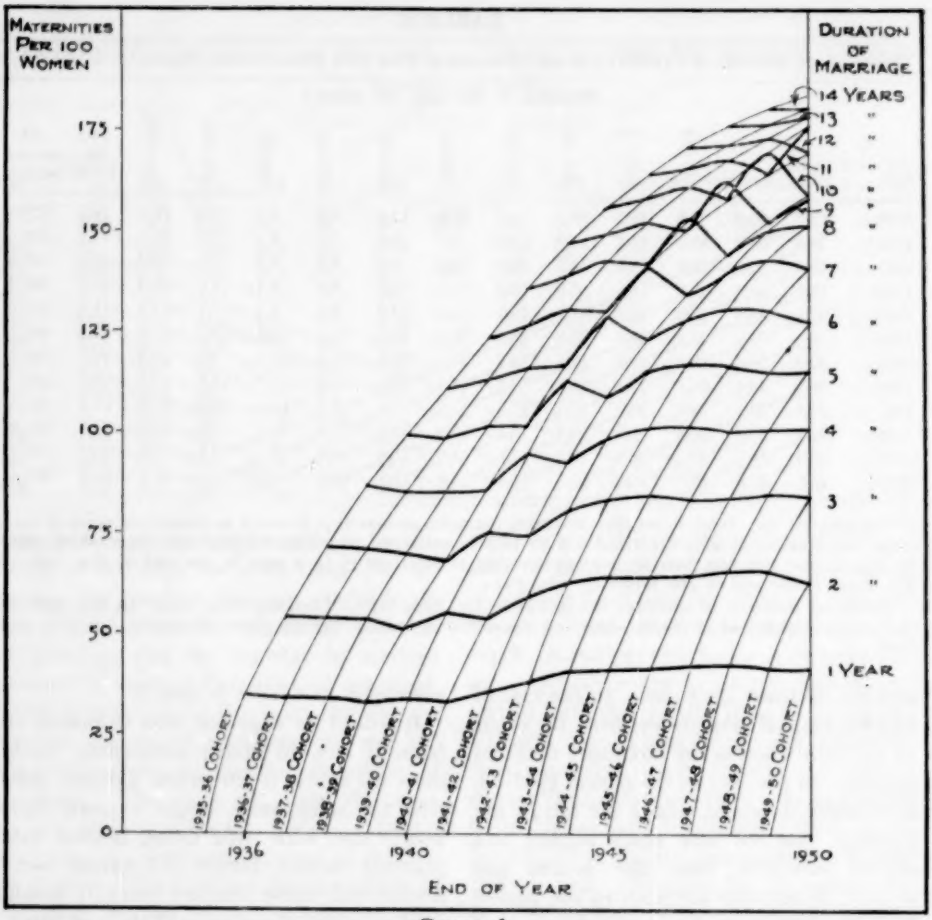

CHART 1

of the unsteady economic conditions and the outbreak of the war. Later on they made up some but not all the births they had postponed. The introduction of family allowances does not seem to have had any effect in this respect as there seems to be no indication that the making-up of births in these cohorts was speeded up in recent years. The cohorts 1941–45 increased their families in a way which was surprisingly uniform during all post-war years. The fact that they achieved a considerably higher family size than the previous cohorts at a similar duration seems to be mainly due to the postponement of births on the part of the latter cohorts rather to any favorable effects of family allowances upon the former cohorts.

In the case of Sweden the recent trend in fertility at high durations is similar to that of Norway. Within young marriages, however, the trend seems to have been different. The rather high level of fertility recorded in Sweden in the early years of marriage during the later war years and immediately after the war was fully maintained in recent years. This happened at the same time as a substantial decline took place in Norway as well as in many other countries, *i.e.*, Denmark, England and Wales and the

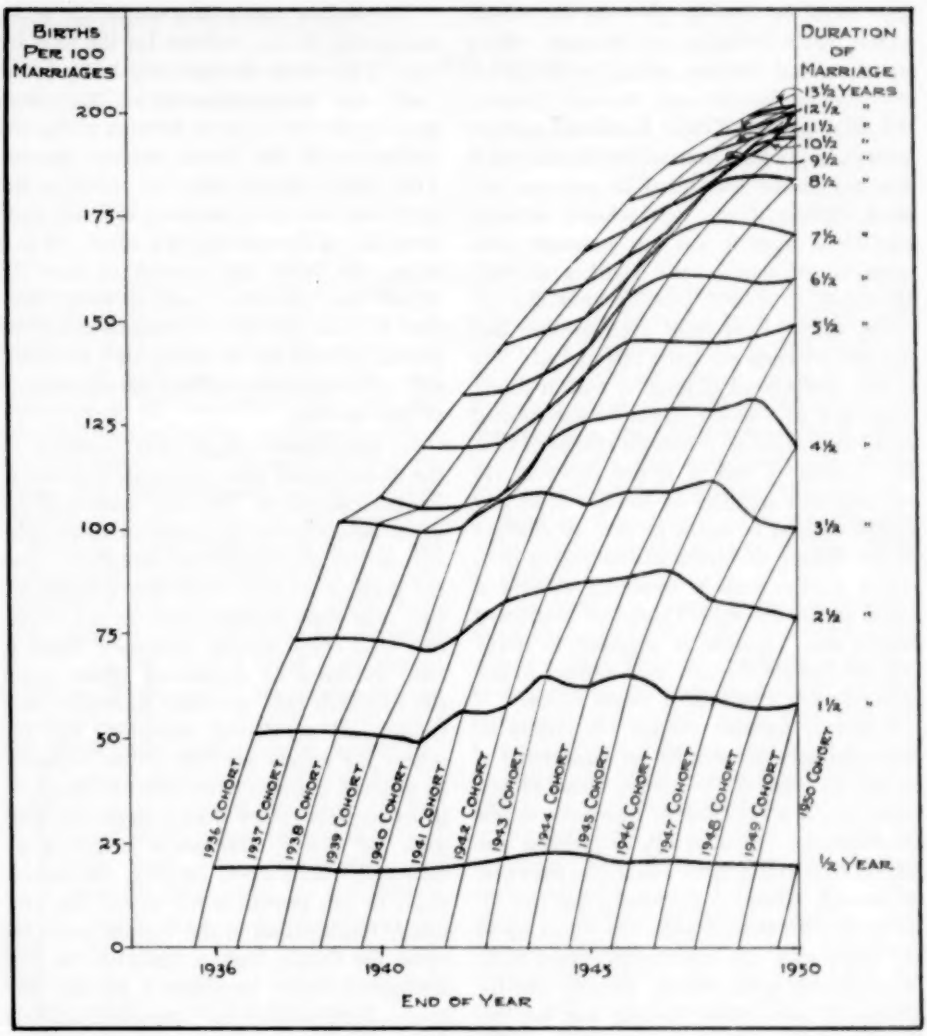

Chart 2

Netherlands. Therefore the evidence available for Sweden does not seem to exclude the possibility that family allowances have had some effect upon fertility in young marriages. The fact that a decline at low durations has taken place in Norway, where family allowances also were introduced, may rather support than speak against the possibility that the scheme might have had some encouraging effects in Sweden. As the allowances in Norway are granted only to the second or any subsequent child a smaller effect might be expected in young marriages in that country than when the allowances apply also to the first child in the family as in Sweden. Further, the introduction of family allowances in Sweden, in contrast to Norway, was a part of a comprehensive and concerted program of measures in favor of the family.

Conclusions

The material presented above on the re-

cent trend in fertility gives on the whole rather little evidence of buoyant effects upon marital fertility owing to family allowances in Sweden and Norway. During the short period of time family allowances have been granted, marital fertility has with few exceptions continued its post-war decline. Thus, if the new scheme actually had some effect it was not generally sufficient to counteract the fertility decline. However, it is still possible that the decrease might have been even greater had the new schemes not been introduced. The rather stable level of fertility within young marriages in Sweden might be interpreted as an indication of favorable effects of family allowances, but it is too early to say whether this stability in fertility is of any significance as it might be due to changes in the timing of births within recent marriages rather than a tendency toward a check in the downward trend of completed family size. Caution is required in drawing definite conclusions with respect to the demographic effects of a single factor.

One may wonder whether the family allowances scheme should be considered a failure in view of the recent trend in fertility. Such a conclusion, however, would be erroneous. First of all, as pointed out above, the demographic effect was only one of several reasons for introducing the allowances. Further, besides the effect upon the birth rate, the allowances might have other demographic effects. Finally, the influence, if any, upon fertility was not expected to be revolutionary in view of the limitations of the schemes. Even if the family allowances have not had any effect upon the birth rate for the population as a whole, they might have had some effect upon fertility in certain groups of families.

The lack of recent data handicaps an investigation of this problem for the time being. The only attempt which could be made was an examination of the recent trend in the birth rate in Sweden within the counties with the lowest average income. The results showed that the trend in the birth rate for such counties differed little from that of the country as a whole. If anything, the birth rate seemed to have declined faster in recent years in these counties, but no precise conclusions could be drawn because the existence of a considerable out-migration modified the significance of the findings.

In the present paper only evidence of the demographic effect of family allowances has been discussed. However, several of the other measures in the program of population policy might also be considered from the point of view of their demographic effect. For some of them, such as the maternity and child welfare measures, there is clear evidence of depressing effects upon the stillbirth rate, maternal mortality, and infant and childhood mortality, but for others the effects are difficult to evaluate. In general, it seems likely that the program in its entirety rather than a single measure such as family allowances might have favorable effects upon fertility. Of importance in this respect is not merely the economic implications of the various measures upon the family budget but also the psychological effects engendered by the program. Particularly, the favorable attitude of the government and changes in the public opinion toward the family might have been major factors. A test of this hypothesis can hardly be made by a direct approach but would require a thorough study of the factors which influence fertility.

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HEREDITY COUNSELING

Diabetes, Pregnancy and Modern Medicine: A Genetic Misadventure

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THE THOUGHTFUL PHYSICIAN is forced to make many illogical, frequently disturbing decisions, during the course of professional duties. In many instances the rights and happiness of the individual clash with the ultimate welfare of the community. Not knowing what is in my mind, I fear the reader will charge me with philosophic ambiguities unless I hasten to illustrate.

A young woman presents herself to the diabetic clinic of the hispital with the statement that she is a monozygotic (identical) twin. She has been a diabetic for six years, but as yet her co-twin, who was studied carefully, shows neither the disease nor its prodromita. However, both sisters have had the singular misfortune of having had three unsuccessful pregnancies ending in spontaneous abortion during the first half of gestation. What would the animal breeder do with such dams? He would weed them from his flock; they are bad "reproducers" and if, perchance, they should succeed in "dropping" living young, the progeny may be "tainted," or if normal may perpetuate a "taint" in his herd.

What does the physician do? What did we do? We studied each twin meticulously in an attempt to unravel the mystery of the abortions. Our investigations included a hysterogram, an x-ray of the uterus after fiilling its cavity with a radiopaque fluid. We premised that the twins may have an identical, surgically correctable malformation of the uterus. They did not, nor did we find any other explanation for the abortions.

Shortly thereafter, with full medical blessing, both again became pregnant. The diabetic twin began to stain at the eighth week and was admitted to a hospital bed, where she remained, flat on her back, in an effort to thwart nature. After 20 weeks and an expense of $2000, borne wholly by the hospital, the patient went into labor and expelled a sick, very premature infant with severe stigmata of maternal diabetes. It died in four hours. The non-diabetic co-twin is approaching term as this article is written.

The fecundity suddenly bestowed upon the diabetic in 1922 by the boon of insulin is not a pure blessing, certainly not a genetic blessing. Since then, diabetic parents have been multiplied many fold and potential diabetic offspring to even a greater number. At The Mount Sinai Hospital, where the author is director of obstetrics and gynecology, at one time recently, its special obstetric-diabetic clinic had 13 pregnant diabetics under supervision. This does not include probably a similar number of pregnant diabetics who had their own private physicians, did not attend the clinic and who also will deliver at Mount Sinai. Mark you, this is the experience of just one large hospital among many in New York.

Even if given very special care, the pregnant woman with diabetes has miserable fetal salvage. Her involuntary abortion rate is 15 per cent in place of the usual 10 per cent and her fetal loss from fetal death during pregnancy and labor added to newborn deaths during the first month of life amounts to at least another 20 per cent. instead of the usual 3 to 4 per cent. In summary, when a diabetic woman under-

takes pregnancy, she has less than a 65 per cent likelihood of bearing a surviving child, in contrast to her non-diabetic neighbor, who has an 86.5 per cent chance. Another problem associated with maternal diabetes is the fact that congenital malformations are approximately three times as frequent among her offspring.

Nature seems to be crying: Don't let the diabetic woman reproduce herself! Despite nature's intelligent genetic viewpoint, modern medicine is doing all within its power to thwart her. And I charge myself with being among the most guilty.

Why? Because the diabetic woman has the same insatiable urge for motherhood as the normal woman. Inability or inadvisability to mother offspring leaves her with the same sense of frustration as any other woman. The doctor who declines to aid her on eugenic grounds would have a petrified heart. The childless diabetic woman's plight is made worse by the attitude of child adoption agencies toward her physical handicap. They prefer to place children in the homes of physically normal parents who have a full life expectancy. Since the demand on most agencies is at least 12 times the supply, few diabetic parents are given children to adopt.

Diabetes is recognized as an inheritable disease, but there is mixed opinion about whether it is transmitted as a dominant or a recessive. What will be the cacogenic sequelae from the special care given to diabetic women to increase fetal salvage? I leave the answer to the professional geneticist. As an obstetrician I simply state the problem. Before 1922, patients with diabetes rarely got pregnant and when they did, in half of the cases neither mother nor child survived. Today at one hospital, approximately 25 pregnant diabetics are now being given prenatal care, which means that in the same institution in the course of the year 50 diabetic women will either abort, lose their babies, or give birth to living surviving children. It is almost 100 per cent certain that all the mothers will survive and that the 50 women will succeed in taking home 33 to 40 infants. Those women who fail will be back next year to try again. Those who succeed will probably return in two years to test their luck again, aided and abetted by the science of modern medicine.

HEREDITY AND DEAFNESS

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EVER SINCE MENDEL CALLED the attention of scientists to the various modes of transmission of inherited characteristics in 1865, occasional studies concerning the transmission of deafness have been made both in this country and abroad. Among the most notable are those of Dr. Alexander Graham Bell and Dr. Edward Allen Fay. That Dr. Bell considered the problem of the inheritance of deafness of paramount importance is shown by the fact that the promoting of research in regard to marriages of the deaf in America, was one of the points stressed by him when he endowed the Volta Bureau in 1887. Dr. Fay devoted himself to the problem over a period of years.

Now more than sixty years later, the fact remains that the problem of hereditary deafness is still far from being solved. This is partly due to the fact that deafness is not a distinct clinical or pathological entity. It is the end result of many different pathological conditions, arising from many different causes and occurring at many different points in the auditory apparatus, but all giving rise to deafness of varied degree and character. On the other hand, deafness may be the result of malformation or defective development of some part or parts of this very complicated mechanism. There are not only many different degrees of deafness, but also many different kinds or types of deafness, depending on the location of the defect or damage. Therefore, we must think not of deafness in general but of the different types of deafness. What is back of deafness in each instance? Any study of inheritance of deafness must in reality be a study of the different types of deafness.

Eugenics, "the self-direction of human evolution," is coming to mean something very real not only to scientists but to every intelligent man and woman. The vital importance of studies in this field of human heredity is obvious. The physician is often at a loss to explain the single occurrence of deafness in a family in which there has been no known history of deafness, or to account for the special predilection for involvement of the middle ear or auditory nerve in certain cases of measles, scarlet fever or other diseases of childhood. Parents and teachers are often at a loss as how to answer the queries of the deaf child when the complete realization of his deafness first comes upon him. How should he be guided toward a wise point of view on some of the most important problems which he must face in adult life? What advice shall be given to a graduate of a school for the deaf who is contemplating marriage with a former deaf classmate? What can we say to the hearing brothers and sisters when they ask whether they may have deaf children if they marry? These were but a few of the perplexing problems which made it seem important that one branch of the Research Department at Clarke School be devoted to the study of the Inheritance of Deafness in the hope that some of these questions might some day be at least partially answered out of Clarke School's own experience.

It would be difficult to find a richer field for research along these lines than Clarke School for the Deaf. It was founded in 1867 and is one of the oldest schools in the United States where deaf children are taught to speak and to understand speech. There are each year approximately 150 pupils ranging in age from four and a half to eighteen years. Those who enter at four

and a half usually remain over a period of ten years until they are prepared to enter high school with hearing children. The majority of the children live at the school. We have from time to time children from old New England families in which there have been accurate records of the occurrence of deafness back over many generations. We have an old and very loyal alumni group, a considerable number of whom, unfortunately, have had deaf children and even grandchildren to send back to Clarke School. We have the complete cooperation of the parents of our children, who are only too eager to do all in their power to help us in our efforts to learn more about the causes of deafness in childhood and the part played by heredity in the production of deafness. And last, but by no means least, we have the children themselves over a long period of years, so that it is possible to study them from many angles, the genetic, the otological and the general medical.

Many of the early studies in this field were made before the recent advances in the science of genetics, in otology, in the physics of sound and in the broader understanding of the relation of the ear to pathological conditions in other and sometimes remote parts of the body. These earlier studies were not based on careful audiometric examinations because there were no audiometers. They did not take into consideration the different types of deafness. In this connection, we are studying the hearing curves not only of each individual child over a period of years but also of as many members of his family as possible. We are coming to believe that, in many families in which deafness has occurred, there are not only deaf individuals and hearing individuals but also individuals with all gradations of hearing defects from the almost imperceptible drops in the hearing curves of some to the profound losses found in others.

Our first step in the study of the inheritance of deafness has been to collect family histories of present and former pupils of Clarke School. The family history has been taken in the form of a pedigree chart, showing all members and going back at least four generations whenever possible. We have tried to bring out on the charts all possible facts regarding the transmission of deafness, the relation between deafness in childhood and hearing defects in early adult and later life, the relation between deafness and many other conditions which may or may not have a bearing on the occurrence of deafness. We have noted cancer, tuberculosis, alcoholism, lues, epilepsy, feeblemindedness, mental disorders, endocrine disturbances, such as goiter and diabetes, and major organic conditions such as heart trouble or kidney trouble, if these have been predominant in the family history.

The greater part of the data from which the pedigrees were made was obtained through personal interviews with parents and with as many other relatives of our children as possible. These interviews took place in the pupil's home or at the homes of other relatives. Some histories represent a single half-day interview, while others represent numbers of interviews with members from different branches of the family over a long period of time. Corroborative evidence was obtained from family doctors, social workers and teachers. Other sources of information include reports from hospitals, school records, genealogical records of certain families, information from family Bibles as to births, marriages and deaths as well as the same type of information obtained from church records and records of Massachusetts towns. Finally some of the data were derived from a community study made in a small rather isolated New England community in which a great deal of deafness had occurred. Here we were able to interview quite a number of individuals between 80 and 90 years of age who were related to two of our present pupils. Sev-

TABLE 1

CAUSES OF DEAFNESS IN CLARKE SCHOOL POPULATION

		1931–1932			1941–1942			1951–1952	
		No.	%		No.	%		No.	%
Congenital		84	56%		119	80%		102	74%
Heredity	53			47			36		
Rubella	2			7			12		
Rh Factor							4		
Birth Injury							1		
Others	29			65			49		
Probably Congenital		24	16%		3	2%		6	4%
Acquired Deafness		42	28%		18	12%		21	15%
Meningitis	17			11			16		
Otitis Media	13			3			2		
Scarlet Fever				1					
Mumps	1			2					
Measles	3								
Tuberculosis	1								
Influenza	1								
Intestinal Toxemia	2								
Virus Infection							1		
Fracture	1			1					
Whooping Cough	3						1		
Rheumatic Fever							1		
Cause Unknown		0	0%		8	5%		8	5%
Total No. of Children		150			148			138	

eral of these told us many interesting stories of the time when Dr. Bell visited this same community and discussed with them the deafness which was at that time very prevalent there.

It is true that many people know very little of their forebears, of the cause of death, of the defects they exhibited when alive, of the illnesses they had, but we do feel that their ability to remember whether or not their relatives were deaf, especially those deaf from childhood is reliable. Since many of the relatives of our deaf children have been educated in other special schools for the deaf, additional corroborative evidence has been obtained from the records of such schools. This material added to the original information from members of the family has yielded data from which very extensive pedigrees could be made. For example, in one pedigree information concerning the individuals in the first six generations and those in part of the seventh was derived from vital statistics and from published records of family archives. This material was obtained some years after we had derived, by means of personal interviews with many relatives of the three deaf pupils in that family, the data used in the rest of the seventh generation and the succeeding generations. Another example is shown in two other pedigrees. Some time after the original information was obtained for one pedigree, we found that this pedigree was closely linked with a community study which we were then making. Still later we found that a much younger pupil in the second pedigree was related to the one in the first and that both were descended from a common ancestor. The family names were different; they came from different parts of the state and had never even heard of one another.

We now have somewhat over 500 pedigrees started. All are made in exactly the same way regardless of whether or not the child was born deaf. A large group of these pedigrees were published in 1949.

In order to determine the part played by inheritance in the production of any condition, an attempt must be made to determine, insofar as it is possible, the dividing

line between the part played by heredity and the part played by environment. Every individual is the result of the interaction of three factors: his inheritance, his environment and his response to each of these. His inheritance is fixed even before his birth; his response is partially fixed by his inheritance, but it is also influenced by his environment and his environment may be constantly changing.

To illustrate: three children may be exposed to scarlet fever, taking scarlet fever as an environmental factor. One child may not contract the infection because his system has sufficient resistance to combat it, that is, he responds adequately to this particular disease environment. The second child may develop scarlet fever but may show no ear complications. His response is not adequate for the disease environment, but he has apparently been endowed with very normal auditory apparatus which is not predisposed to the attack of toxins and infections. In all probability his pedigree will show few members of his family suffering from ear complications after infectious diseases. The third child may contract scarlet fever and become partially or profoundly deaf as a result. Your first reaction is that his deafness is the immediate result of the scarlet fever, that there can be no inheritance factor. However, not every child who has scarlet fever becomes deaf. In all likelihood the third child had inherited a weakened auditory apparatus which was predisposed to be affected by toxins entering the system. His pedigree is apt to show that an aunt has become partially deaf following pneumonia or a grandmother after typhoid. In some families toxins seem to have a predilection for the auditory apparatus. Just as some individuals are born with weak lungs and develop tuberculosis if their environment or their response is inadequate, so some individuals are born with an auditory apparatus which functions normally for a time but is inadequate to withstand disease and other effects of a poor environment.

In spite of all that has been written about congenital and hereditary defects, there is still confusion in the minds of many doctors, otologists, and most lay people as to the meaning of the two terms. The terms *congenital* and *hereditary* are neither synonymous nor are they mutually exclusive. *Congenital conditions exist at birth.* Hereditary conditions are determined by factors in the germ cells. Applying these two terms to deafness, we find that though heredity accounts for a large number of the instances of congenital deafness, there are many other things which can cause congenital deafness, that is, deafness present at birth. On the other hand, hereditary deafness is by no means always present at birth. Otosclerosis, one type of hereditary deafness, seldom appears before early adult life. It might be well to discuss a little the causes of deafness as we know them.

Etiologically, congenital defects fall into two main groups: first, those which are genetically determined, where the fault lies in the genes themselves; second, those resulting from adverse conditions affecting the developing ovum. It is certain that inheritance plays a large part in the occurrence of many types of deafness whether or not the child is born deaf. Injury to the germ plasm may result in complete absence or defective development of any part or parts of the auditory apparatus.

The external auditory canal may be closed, the tympanic cavity may be malformed, the ossicles may be lacking, defectively developed, or the stapes may be ankylosed to the oval window. The bony labyrinth may be malformed, the round window may be closed with bone, or the organ of Corti may be entirely absent or defectively developed. There may be atrophy of both branches of the auditory nerve, or the defect may be in the auditory pathway or in the auditory centers of the brain.

Therefore, in a child born deaf you may expect to find any type or degree of deaf-

ness according to the location and extent of the defect. However, the fact that a child is born deaf does not necessarily mean that there is an inheritance factor. He may have had a normal auditory apparatus, but the nerve may have been injured at birth, producing deafness. Here there could be no question of inheritance any more than when a child is made deaf through an accident in later life.

Congenital syphilis may have partially destroyed the auditory nerve before birth. Here again the child was originally endowed with a normal auditory apparatus which was injured by infection during intrauterine life.

A few years ago, following an epidemic of Rubella (German measles), it was discovered that many of the pregnant mothers who had the disease produced defective children. Deafness is one of the defects so produced. There are now recorded a number of instances in which fetal defects have followed maternal disease other than Rubella. Diseases which have been mentioned in this connection are mumps, measles, influenza, and even shingles. If the mother has any of these diseases during the first three months of pregnancy, she is pretty certain to produce a defective child. The more common defects have been congenital cataracts, congenital heart defects, and deafness as well as many other defects. When the mother has the disease during the first month of pregnancy, the child may be born with several defects.

It is also possible that certain drugs, such as quinine given a mother during pregnancy may enter the fetal circulation and produce degeneration of the auditory nerve and deafness.

Very recently we have had several children whose deafness was attributed to Rh incompatibility. Comparatively little scientific data is available regarding this condition although it has received considerable publicity in the lay press. Much of this has been without scientific foundation, and much of it is in error. As yet there is no definite information to explain the appearance of deafness in children with a history of hemolytic disease at birth. However, we do know that a test for the Rh factor should be part of the first examination of every expectant mother. If her blood proves negative and her husband's positive, the doctor will want to check her "antibody level" throughout her pregnancy so that he can tell what to expect when the baby is born. He can then have available at the time of delivery a donor whose blood is Rh negative, and the minute any signs of disease appear he will start blood transfusions Many times all the blood in a baby's body is replaced by transfusion. These babies usually flourish and grow into healthy, normal children.

The environmental factors which can cause deafness can be listed under five headings:

1. *Climate*—In deafness originating in troubles of the nose and throat, it is well known that a damp climate with sudden changes of temperature is likely to increase the hearing deficiency by aggravating the nose and throat trouble.
2. *Home Conditions*—Since the auditory apparatus is so easily influenced by a child's general physical condition, poor home surroundings, malnutrition, etc., are bound to affect the auditory apparatus.
3. *Injuries*—Deafness is occasionally the result of a birth injury but not very often. However, there is no doubt but that a fractured skull can produce deafness.
4. *Occupation*—Among older people there are many occupations in which the worker is subjected to almost constant noise, and deafness often follows.
5. *Disease* is the most important environmental factor which causes deafness. There are three chief ways in which disease may reach the more important parts of the auditory apparatus:
   a. By direct extension from the nose and throat through the Eutachian tube to the middle ear
   b. Through the bloodstream from distant points of infection

c. From the meninges and cerebrospinal fluid surrounding the brain.

Infection originating in the throat and nasopharanyx has an easy approach to the middle ear through the Eustachian tube. This is especially true in babies and young children in whom the Eustachian tube is much shorter than in the adult. Also in babies the pharyngeal end of the tube is in line with the hard palate and often imbedded in adenoid tissue, so infection travels very easily from the nose and throat through the short horizontal tube to the middle ear and here results in an acute otitis media, or abscessed ear. If prompt attention is not given at this point many serious results may follow.

In the various infectious diseases, such as measles, mumps, scarlet fever, etc., toxins are circulating in the bloodstream and are likely to attack a point of lowered resistance. The auditory nerve seems to be such a point. There is first a toxic neuritis of some or all of the fibers of the auditory nerve, and later a degenerative process begins and continues until very little function may remain. It is quite possible to have a middle ear infection and a toxic neuritis affecting the auditory nerve going on at the same time or either process may take place separately. But when deafness is profound enough to necessitate special education, the nervous mechanism has usually been involved to a greater or less degree.

The third and very important way by which infection may reach the auditory apparatus is from meninges (the coverings of the brain) along the sheath of the auditory nerve to the inner ear. This is what happens in meningitis, which may be due to a variety of organisms.

Since the advent of the newer drugs, we are having far fewer cases of acquired deafness. Ear infections are cleared up much more quickly than they were in the past, and there are fewer complications. The one exception is in the case of meningitis. In the past it was said that possibly half the children who had meningitis did not recover and, that of those who did, possibly half were deafened. Now there are very few deaths from meningitis, but we are still getting about the same number of children deafened by it. However, this number is a much smaller proportion of the total number of recoveries than it used to be. The new drugs not only speed the recovery, but we also find that those who are deafened have in many cases far more residual hearing than we ever found in the past.

In the probably congenital group we include those cases in which the child, the only deaf individual in the family, has never given any real evidence of hearing and in which the explanation given by the parents to explain the child's deafness seemed too inadequate. In 1931 we had twenty-four cases of this type, in 1951 only six.

We always have a very small group which we call the unknown group. It has been impossible to classify these cases for various reasons. The greatest number of them are adopted children. The evidence in all these cases was either so scanty or so conflicting that it was not possible to even guess where they belonged.

In the hereditary group we include these cases: (a) more than one deaf child in family, (b) one or both parents deaf, (c) history of congenital deafness either in a collateral branch of the family or in one of the direct ascendants, (d) deaf pupil had married and had deaf children, (e) parents were related.

Our congenital group remains approximately the same size over the years. Each year it includes a large group where we cannot say definitely that the deafness is inherited, but we can find no other reason to account for its appearance.

In trying to summarize our large collection of data, there are some definite conclusions we may make. We have found

that deaf children were no more susceptible to middle ear infections than their hearing brothers and sisters. This casts doubt on the frequent assertions of parents that their child's deafness is due to otitis media. We have found that though some authors feel that other congenital defects have been influenced by birth order in family, deaf children tended to occur at random through the family. They were not born either first or last in any excess numbers. We have found that the mothers of our deaf children were not older than the average mother so that we feel that maternal age does not influence the production of congenital deafness, though some authors feel that it does influence the production of some other congenital defects. We have found that deaf children were not born at a time when the reproductive efficiency of the mothers was lowered, as evidenced by the number of miscarriages immediately preceding or following the birth of the deaf child. Some authors feel that such reproductive inefficiency may be related to the occurrence of some other congenital defects. We have examined numerous extraneous factors, all of which have been invoked to explain the occurrence of other congenital defects. We do not feel that they have been a contributing factor either directly or indirectly in causing deafness. We feel that a much larger percentage of congenital deafness may have been caused by heredity than has been thought by many workers in the past. Many of the apparently sporadic cases of deafness found in our group of pedigrees may in reality be due to heredity. The basis for the appearance of deafness in this group of congenitally deaf children is a factor for deafness which they inherit from their parents. That is, they do not inherit the factor for normal hearing, hence the lack which results in the condition which we call deafness.

We still do not have sufficient knowledge to speak dogmatically about deafness, but we do feel that it is our duty, as the opportunity arises, to give young deaf people and their families the benefit of the knowledge which we have and to help them to realize the true situation: if they marry either a deaf or a hearing individual they may have deaf children or they may have hearing children. If they have hearing children, the deafness may still appear in their grandchildren or great grandchildren, or even in a later generation. They must also realize that deafness may be transmitted through hearing as well as deaf members of the famiy. Hearing members who marry individuals with a family history of deafness are quite as likely to have deaf children as their deaf brothers or sisters. They should also be told that the fact that they may have been deafened by meningitis, for instance, does not eliminate the possibility that they may be a carrier of deafness which may be handed down to their children in the future. To many deaf people this is an entirely new idea.

The problem of hereditary deafness is still far from being solved. However, progress is being made and more and more people are becoming interested in the problem.[1]

[1]The Clarke School family histories referred to in this article are found in the following: Hopkins, L.A., & Guilder, R.D., 1949. Clarke School Studies Concerning the Heredity of Deafness, Monograph I, Northampton, Mass.: The Clarke School.

BOOK REVIEWS

COHORT FERTILITY: NATIVE-WHITE WOMEN IN THE UNITED STATES: P. K. Whelpton, Princeton University Press, Princeton, 1954, XXV + 492 pp. $6.00.

One decade ago (October 3, 1944) the reviewer was privileged to attend a meeting of the American Public Health Association in New York City and to hear a paper presented by P. K. Whelpton entitled "Effect of Increased Birth Rate on Future Population."[1] Breaking down the recent birth rates by order of birth, Whelpton argued that since the increase in the birth rate up to 1942 was due mainly to lower order births, it probably did not connote any increase in average size of completed family. For the same reason he argued that the recent increase in the birth rate probably would have little effect on population growth in the long run.

Although Whelpton's opinion on the last-mentioned point was not borne out, the paper was significant mainly because it pointed up at once the abnormal character of the period with respect to the high rate of first births and also an important deficiency of the reproduction rate. In the words of Whepton: "With 1942 came the impossible. In a cohort having 1942 age-specific rates for first births, 109 of each 100 women living through the childbearing period would have at least one child."[2] During the following years Whelpton wrote other articles on the significance of the baby boom and one article was devoted to suggested refinements of the net reproduction rates in order to avoid logical absurdities of the type mentioned above.

Whelpton's interest in securing more refined measures of fertility trends probably was intensified after it became apparent that the persistent increase in the birth rate would have much influence on future population. Whatever may have been his driving force, Whelpton's search for more adequate measures of fertility has resulted in a book which probably will be used a great deal during the next decade.

Whelpton explains the need for cohort fertility data as follows: "The unprecedented increase of nearly 32 per cent in registered first births which occurred from 1940 to 1942 led to a recognition of the importance of trying to ascertain how much of it was due to (a) the starting of families that had been postponed during the depression years of the 1930's; (b) the advancing of families that would have been started after 1942 if economic conditions had not improved so greatly during 1939-41 and there had been no threat of war involving the United States; (c) a decrease in the proportion of women remaining single; and (d) a decrease in the proportion of married women remaining childless. The same questions were posed even more forcefully by the amazing 67 per cent upsurge in registered first births from 1945 to 1947." (p. 12.)

In the lexicon of the demographers, a cohort is a group of people of the same or approximately the same age who are observed as they pass through life or a portion of it, such as the reproductive ages.

As described by Whelpton, "Fertility tables for two types of cohorts—'actual' and 'hypothetical'—are presented in this monograph. Each actual cohort consists of the white women who were born in the United States during a given twelve-month period centering on January 1. For example, the native-white women born from July 1, 1899 to June 30, 1900, inclusive, constitute the actual cohort of 1900. . . ." (p. 16.)

"The hypothetical cohorts are defined here in accordance with the principle used in connection with life tables and gross or net reproduction rates, *i.e.*, the hypothetical cohort of year *y* consists of a group of women who are assumed to have been born at the first instant or year *y*, and to have experienced throughout their life the demographic conditions of that year. This means that at successive ages they are assumed to have the mortality and fertility which successive actual cohorts had during year *y*." (p. 17.)

In this book the author has, perhaps wisely, elected to present the basic tables in detail and to write rather sparingly about the tables. Three pairs of tables for actual cohorts and two tables for hypothetical cohorts occupy over one-fifth of the book, *i.e.*, over 100 pages. In each pair of tables for actual cohorts, one table relates to each actual cohort (women born in a given year) and the other to cohorts in groups of five. Thus Table A (eighteen pages in small type) shows "for each actual cohort [1875 through 1933] the cumulative birth rates, by order of birth by single year of age of mother, for the women surviving to each [possible] age from 16 to 47." Table B presents similar data for cohorts in groups of five. (p. 19.)

[1]This paper was published in the April, 1945 issue of *The American Journal of Public Health.*
[2]*Ibid.*, p. 350.

Table C presents for each actual cohort (and Table D for cohorts in groups of five) "the number of survivors at each exact age from 15 through 47, classified by parity, per 10,000 initial members of the cohort." (p. 20.)

Tables E and F present for each cohort and group of cohorts ". . . the probability that the women of each parity living at each exact age will bear a child during the one-year age interval." (p. 20.)

Table HA relates to hypothetical cohorts and presents data corresponding to Table A described above. By a simple computation the data in Table HA can be converted into net reproduction rates adjusted for parity, sterility, and spinsterhood. Table HC also relates to hypothetical cohorts and corresponds to Table C. Whelpton goes to considerable pains to describe the method of computing the cohort fertility tables and to assess the validity of the results.

A good indication of the extent to which the increase in the birth rate during the past 10 years has been due to low-order births is given concerning probability of birth of $n + 1$ order during the next year among women of n parity and of given age. "The probability that zero-parity women of a given age would have a first birth within a year declined about one-third between 1920 and 1933, and rose in much greater degree between 1933 and 1947. . . From 1920 to 1948 the probability that six-parity women would have a seventh birth fluctuated irregularly at ages 25–29 but had increasingly steeper downward trends at successively older ages." (pp. 90–91.)

Under described "high," "medium" and "low" assumptions, Whelpton presents forecasts of completed fertility rates and cumulative fertility rates by order of birth. Since the author is largely concerned with whether or not an increase in average size of completed family is in the offing, attention here will be restricted to total completed fertility rates. First of all it will be noted that the actual fertility rates per 1,000 women by ages 45–49 in the past declined steadily from 3,492 (3.5 per woman) for women born during 1875–79 to 2,483 for cohorts of 1900–04. For later cohorts in groups of five, estimates are required, since all women have not yet reached 47 years of age. Under "high" assumptions the completed fertility rate is 2,349 for the 1905-09 cohort and thereafter increases regularly to 2,792 for the 1930–34 cohort. Under "medium" assumptions the rate increases from 2,337 for the 1905–09 cohort to 2,550 for the 1920–24 cohort and then declines again to 2,477 for the 1930-34 cohort. Even under "low" assumptions the downward trend in average size of completed fertility is interrupted for the cohorts of 1915–19 and 1920–24. Thus it seems rather clear that there will be at least a slight and temporary interruption of the long-time downward trend in average size of completed family.

One of the important components of the increase in the birth rate has been the marked increase in the proportions married by ages 25 and 30. As Whelpton points out, however, *yearly increases* in births through lowering of age at marriage can in the nature of the case endure only while the *changes* in marriage age are in process. Whelpton points out "It seems safe to conclude . . . that the recent and probable future changes in age at marriage will tend to cause only relatively small increases in the average size of completed families." (p. 205.)

Perhaps the chief weakness of Whelpton's approach in this work is that he is too exclusively concerned with what fertility trends signify in terms of future population growth and average size of completed family. To him changes in the age at marriage and timing of births seem to be of little concern if they do not signify changes in average size of completed family. Many sociologists perhaps are much less concerned about the total population growth than they are about the changes in proportions married, changes in family composition at successive ages, and changes in general biotic aspects of the family as an institution. Nevertheless, as in his previous work, Whelpton presents solid materials of interest and of potential use to workers in a wide variety of fields. He has made many indebted to him again.

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Colonial Development and Population in Taiwan: George W. Barclay, Princeton University Press, Princeton, New Jersey, 1954, xviii, 274 pp., $5.00.

This book invites attention for three reasons: it is a thoughtful analysis of a singularly good body of demographic data; it is a uniquely detailed demographic documentation of an agrarian society; it describes the effects upon that society of a particular kind of colonial development. The foundation upon which the book rests is the collection of census and vital statistics material gathered by the Japanese in Taiwan between their occupation of the island in 1895 and the second world war. One of the services rendered by Barclay in con-

nection with his study was to apply to these data a series of tests that demonstrate them to be of a quality that would be considered excellent even in a much more highly developed area of the world.

The book begins with a very readable presentation of the economic and social setting in which the demographic development of Taiwan took place, moves gradually into detailed consideration of a variety of aspects of this development, and concludes with a brief chapter suggesting implications of these facts for the future. Though careful exposition of methodological problems brings the skeleton of the work rather close to the surface at times and gives some of the text a gaunt aspect that will not at all points appeal to the popular reader, this very feature adds a solidity that will be appreciated by the serious student. At least the first three and final chapters will be of interest to a wide audience.

The story that emerges is that of the growth of a population of Chinese descent, living in a thoroughly Chinese agrarian culture, at an average annual (geometric) rate of 1.76 per cent during the half century following the cession of Taiwan to Japan. At the time of the first census, in 1905, 70 per cent of the occupied male population was employed in agriculture. For males the expectation of life at birth was 28, and for females 29. About 47 per cent of females 15–19 had been married at least once, and more than 99 per cent of those over 35. The gross reproduction rate was of the order of 2.9. The crude rate of natural increase was 8 per thousand per year. Thirty years later this agrarian, high-fertility, high-mortality society had become an agrarian, high-fertility, lower mortality society, with a crude rate of natural increase of about 24. While the expectation of life had risen to 41 and 46 for males and females, respectively, and marriage tended to be somewhat delayed for women (28 per cent of those 15–19 had been married), the propertion of women eventually marrying had remained near the maximum possible and fertility was virtually unchanged. The percentage of employed males engaged in agriculture had dropped only to about 68 per cent. Meanwhile the efficiency of the island as a producer of raw material, particularly food, for the Japanese empire had been vastly enhanced.

In addition to describing the general process outlined above, Barclay's study examines a number of other detailed aspects of Taiwanese demography such as household structure, divorce, and internal migration, though data are not always available for consideration of each topic over the whole period of Japanese occupation. For the most part the reviewer is not inclined to debate the selection or presentation of material in the volume. The former is limited by the data and the purpose of the book; the latter is almost always shrewd and thorough. A few points, however, may be suggested. To some extent there may be a tendency in the book to minimize the importance of changes in the system by directing attention chiefly to large components and dismissing changes involving small numbers. An example occurs in the discussion of the relative growth of cities of different size, where it is asserted that between 1920 and 1935 the biggest cities "failed to advance substantially over the rest of the population" (p. 106). In the sense that the population in the cities in question was 6.6 per cent of the total at the earlier date and 7.6 per cent at the later, this is a reasonable statement, but it is well to observe that during the fifteen-year period these cities increased in size by 60 per cent, while the rest of the island increased by only 40 per cent. A characteristic of the volume that might well be emulated is the avoidance of hasty or sweeping conclusions drawn from inadequate evidence. Yet one feels that occasionally the reader is deprived of useful informed speculations and analysis that could be based on a combination of the evidence available and relevant theoretical considerations. Thus the discussion of the net effect of improved mortality and later marriage on the amount of time spent by Taiwanese women in marriage (p. 231) could probably be extended with profit. The application of the analytical framework of the "cohort" approach, alluded to in a footnote, could contribute something to an understanding of the situation even in the absence of the desirable large quantities of data.

Although the book is not intended as a compendium of facts, and stresses aspects of Taiwan's development that are of general significance (cf. p. 255), in a few instances it would have been quite helpful if somewhat more comprehensive data had been published for the benefit of readers who have no access to the original sources. Most sorely missed will probably be a table giving the distribution of the population by age and sex at all, or several, of the census dates. As it stands, however, the book is copiously supplied with tables, graphs, and maps. An index completes a volume that will be fascinating and instructive to persons interested in a wide variety of problems.

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ABSTRACTS

GENETICS

Medical genetics in pediatrics, F. C. Fraser. *Journal of Pediatrics* **44** (1954), pp. 85–103.

Intended for the practicing physician, this review begins with a simple explanation of Mendelian inheritance as illustrated in some human diseases. The author then goes over the points in a family history that are essential for the diagnosis of hereditary diseases, and the principles to be considered in counseling parents who have an abnormal child or abnormal close relatives. In obtaining a family history a physician should emphasize diseases relevant to the patient's complaints; he should concern himself mainly with the immediate family including all siblings and should inquire specifically about consanguinity in the parents. The author does not recommend telling parents whether or not they should have another child but would help them to weigh the following considerations: (a) the statistical risk that another child will be abnormal, (b) the seriousness of the abnormality in relation to the potential assets of children born in such a family, (c) the parents' desire for children, (d) possible solutions open to the parents, and (e) the effect on future generations, though the last is usually obscure in the present state of our knowledge. The remainder of the paper gives an alphabetical list of nearly fifty pediatric conditions for which a genetic basis is suspected, with tentative conclusions about inheritance and with key references for each.

Hereditary influences in relation to the problem of child adoption, L. S. Penrose. *Bulletin of the World Health Organization* **9** (1953), pp. 417–422.

The application of genetic knowledge to problems of adoption is limited to the prediction of chance events and is least precise for traits influencing social adjustment, in which prospective parents are usually most interested. These predictions cannot be relied upon to the exclusion of thorough physical and mental examinations of the child, although they may assist in such examinations. Knowledge of proved hereditary defects in the immediate relatives is important when available, and intelligence or stature will generally deviate from the average in the same direction as that of the true parents. The latter traits, however, are probably subject to significant alteration by the environment.

A test for heterozygous deleterious recessives, S. C. Reed. *Journal of Heredity* **45** (1954), pp. 17–18.

Muller has estimated that the average human carries about eight recessive deleterious mutations. A test of the approximate correctness of this estimate should be possible from adoption agency data on father-daughter incestuous matings. Half of a man's daughters would inherit any particular recessive gene from him, and the probability is one-fourth that a baby born to such a daughter by her father would manifest the defect. The proportion of defective and normal offspring in a series of such cases would yield information on the number of hereditary defects in the fathers, and this should be representative of the general population with respect, at least, to physical abnormalities. However, as a check on Muller's estimate, the method would disclose only a fraction of the deleterious genes actually present in the fathers; the others would be lethal in the embryo or unidentifiable in the child.

Matings of this kind, though relatively rare, could probably be found in adequate numbers by a wide and systematic search, and they could be supplemented with brother-sister and other incestuous unions. In terms of theoretical genetics, this type of investigation might be as fruitful as the study of twins. Like the twin method, it would lend itself to elaboration and refinement.

The problem of adaptive differences in human populations, T. Dobzhansky and B. Wallace. *American Journal of Human Genetics* **6** (1954), pp. 199–207.

An individual's "genotype" is the characteristic combination of genes which occurs in practically all the cells of his body. From the study of abnormal genes and their simpler combinations, genetics has turned its attention toward the more complex interactions of normal and abnormal genes in varied genotypes. Adaptation of a species to its environment is seen to depend not only on insuring a favorable and integrated genotype for the majority of individuals but also on the maintenance of diverse genes in optimum proportions within the population as a whole, or the construction of an integrated "population genotype."

According to the oversimplified concepts of earlier geneticists, natural selection involved merely the elimination of deleterious mutations

and the multiplication of favorable ones. It has been shown in fruit flies that the same gene which has harmful effects in the double (homozygous) state or in certain genotypes may be advantageous in the single state or in combination with some other genes. In such an instance, and perhaps very commonly, natural selection maintains the gene at an intermediate frequency.

In fruit flies it is usually found that each local population or racial group has evolved its own optimum genotype and suffers, at least temporarily, from crossing with another population. This fact cannot safely be carried over to the problem of race-crossing in man, but emphasizes the tendency of natural selection to adapt populations or species at the expense of individuals, often by multiplying genes which are potentially deleterious.

Research designs in psychological genetics with special reference to the multiple variance method, R. C. Cattell. *American Journal of Human Genetics* **5** (1953), pp. 76–93.

The nature of normal psychological traits precludes their analysis by the classical methods designed for unit Mendelian characters. It is possible, however, to study the variance of such traits and to estimate the relative contribution of heredity and environment to this variance in the form of "nature-nurture variance ratios." Most objections to this approach can be met by methodological refinements or by circumspect interpretation of the results.

Excepting genotype in identical twins, neither genotype nor environment can be held constant, but one can compare individuals from categories in which the genetic and environmental variances have different relative magnitudes. For example, brothers have the same genetic variance regardless of environment, but brothers separated and reared in different homes should have a greater environmental variance than brothers raised together. The multiple variance method would combine several such comparisons in a set of simultaneous equations, permitting estimation of all the variances and of the major correlations among them. The total variation of a trait could then be apportioned between heredity and environment and, within each of these, between family differences and individual differences. The most useful single comparison for this purpose would be between identical twins reared together and apart, but an adequate collection of separated pairs is probably unobtainable.

The author outlines a project which is intended to solve five simultaneous equations with psychological test data obtained on 350 to 450 children, including twins and adopted children. Although the design of the experiment requires some simplifying assumptions, it will represent the first attempt to estimate true nature-nurture variance ratios. The findings should have general validity, within the cultural and racial group, for specific traits studied.

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POPULATION

The intelligence of urban and rural children. W. G. Emmett. *Population Studies* **7** (1954), pp. 207–221.

In the words of the author "The purpose of this inquiry was to compare the mean intelligence of urban and rural children." The subjects are British school children eleven years of age and the statistics were provided by "twenty-five County and twenty-two County Borough Education Authorities" (p. 207).

"The intelligence tests in question were constructed in the Education Department of the University of Edinburgh. . . . They contained questions mostly of the verbal type, involving analogies, opposites, classification, codes, series, problems, etc." (p. 207).

As for results, the mean scores obtained by urban children tended rather consistently to be higher than the mean scores attained by rural children. Many students have pointed to results of this type as an illustration of the limitations of the intelligence test in so far as the measurement of native intelligence is concerned. In this instance, the author rather defends the test by stating "Factorial analysis indicates that they measure general ability commonly known as intelligence, or '*g*', and in lesser degree a verbal ability. Whether the mental function is indeed 'intelligence' as variously defined by psychologists is irrelevant; it is sufficient that it plays an important part in all forms of abstract thought and therefore has great sociological significance. For the time being we call it 'intelligence'" (p. 208).

However, a secondary finding in the study is one concerning differences by sex. Within each type of community, the scores secured by girls are consistently higher than those secured by boys. In fact, the differences by sex tend in general to be more impressive than those by type of community. It is true that the differences by sex are inversely related to degree of urbanization. The point of interest to the re-

viewer, however, is that whereas the author explains that "these sex differences are mostly temporary and are likely to be due to environmental influences" (p. 214), he expresses the belief that "the observed differences in intelligence [by urban-rural status] are likely to persist if migration from one district to another is on a small scale" (p. 218).

Intelligence and family size, I. Th. Papavassiliou. *Population Studies* **7** (1954) pp. 222–226.

This study may be regarded as a replication in Greece of many studies carried out in the United States and England on the relation of fertility of parents to intelligence-test score of school children. For one series of data, a total of "349 children in Athens were given individually the tests of Prof. G. Sakellariou, which are the Greek adaptation of Terman's intelligence test of 1917" (p. 222). The results from this series show mean family size consistently increasing with lowering of I.Q. of the child.

In another series 183 children 7–12 years of age in Athens (restricted to children from families of "almost complete fertility") was used for a study of the relation of I.Q. to the occupational level of the father. Again as expected, the I.Q. scores made by the children are directly related to father's occupational class. Mean family size is inversely related to occupational class.

The author presents a balanced interpretation of the results. He notes that on the basis of some of the earlier studies of this type Cattell and others had predicted declines in average I.Q. He also notes that the recent study, *Trend of Scottish Intelligence*, failed to find any evidence of any appreciable secular trend in average I.Q.

The author explicitly disavows any intention of discussing the reasons for the foregoing "paradox." He notes, however, that "inter-racial comparisons do not show a lower intelligence in some very fertile peoples (e.g. Japanese against European)," that high fertility is frequently offset to some extent by high infant mortality, that the "inheritance of intelligence is a complex phenomenon," and that "progress of civilization may cause a rise in mean intelligence."

The author concludes with a recommendation for a eugenic program "whether or not it is true that mean I.Q. may fall in future generations". He expresses the belief that "it would be of interest if the influence of contraceptive techniques on the relation of intelligence to family size were to be studied in detail (p. 226).

Analysis of changes in the marriage pattern by economic groups. John Hajnal. *American Sociological Review,* June 1954, **19,** 3, pp. 295–302.

In two former articles, one of which was annotated in these pages of the March 1954 issue of EUGENICS QUARTERLY, Hajnal presented a novel technique for studying trends in age at marriage from census type of data on proportions single by age. In the article listed above he deals with the marriage patterns of groups with certain economic characteristics.

Hajnal found that in some countries, notably Australia and New Zealand, the wartime and postwar increase in the marriage rate differed little by socio-economic status. On the other hand, the data for the United States, Denmark, Sweden, and Switzerland suggest that "The change in marriage tendency has been greater (a) in urban areas than in the countryside; (b) among the more educated than among the less educated; and (c) among employees than among employers" (p. 300).

Like others, Hajnal emphasizes that the baby boom arose in part from the marriage boom. "However, the more complex question of what changes have occurred in the childbearing behavior of married couples in different socio-economic groups and how these changes are related to the differential marriage pattern has not yet been answered" (p. 301). The author raises the question: "Could it be that early marriage or even the early starting of a family is no longer felt to be a rash act for a young man in circumstances where social norms formerly would have demanded delay?" In this question, the author's tacit implication would seem to be that, like Barkis, the young woman always has been "willin' ". Whatever that situation may be, the author concludes his article as follows: "Perhaps in a world of uncertainty the future is more readily being discounted in favor of present enjoyment. Or the economic factors involved in marriage and setting up a household may have altered. The economic transformations of the last few decades might well be analyzed from the point of view of their effects on people's economic aspirations and on the standards regarded as prerequisites for marriage. The changing norms in respect to marriage may be intimately connected with fundamental changes in modern society" (pp. 300–301).

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TRENDS IN EUGENICS

Influences on Distribution of Births

The eugenics movement seeks to make it easier for parents with sound heredity and wholesome family life to bear as many children as they wish. This column reports instances of trends in research and in economic, social, and psychological conditions which may affect the size of different types of families. The Eugenics Society does not necessarily sponsor measures reported here.

Canadian Social-security System and U. S. Family Allowances

Already proposals for family allowances—government payments to families for the benefit of children—are being urged in the U. S. by many trade unions, by the American Public Welfare Association, and by legislators. If family allowances eventually are adopted in the United States, they probably will resemble in substantial measure the program that has been in effect in Canada since 1945.

A Canadian mother receives from the Dominion government a total of $1,128 between a child's birth and its sixteenth birthday. By law, the money must be spent directly for the welfare of the child. Family allowances are tax-free and payment goes to all families. The allowance, according to Canadian law, is to be applied exclusively toward the maintenance, care, training, education, and advancement of the child.

The total sum spent on family allowances amounts to 350 million a year, family allowance checks being mailed each month to 2,074,042 Canadian mothers. The average allowance per child is $6.04 monthly.

In the United States, Senator Murray has told his colleagues that the "question of family allowances must be met in the re-examination of our entire Social Security program." If Canada's exact pattern were followed, family allowances would cost the U. S. Treasury approximately 3,888 million dollars annually. But they would seem a highly effective pump-primer if the present downturn gets worse. The bulk of family-allowances checks would be poured at once into the business stream. A great majority of the country's families would benefit from such a program because of the bumper crop of war babies.

Family allowances may be a familiar phrase in the United States by the time Congress becomes serious about taking another look at the entire problem of Social Security here. Perhaps it will then seem politically, economically, and socially wise to be as concerned about welfare in infancy as in old age.

(Abstracted from "Canada's Social Security System for Children," Richard L. Neuberger, *The Reporter*, April 27, 1954, by permission of the author.)

Tax Relief for Educational Expenses

High income taxes are contributing to the shortage of engineers, teachers, and professional men in the United States and also to the decreased enrollment and mounting deficits in privately endowed colleges, according to Dr. John N. Schlegel, Treasurer of Lafayette College. It is because of these factors, said Dr. Schlegel, that administrators of such colleges and educators in general are showing interest in the proposal made at this session of Congress to provide some tax relief for parents through deductions for educational expenses.

A number of Congressmen have introduced bills which would allow a deduction for income tax purposes of certain expenses incurred by the taxpayer for a dependent. Dr. Schlegel said that the tax on incomes of $4,000 and up has for the last ten years equaled the tuition at most colleges in the nation and that as a result it has been difficult and often impossible for many parents to give their children higher education. A survey he made of twenty-five colleges with enrollments under 3,500 shows that the colleges have increased student aid to such an extent that huge operating deficits have resulted, Dr. Schlegel stated.

The survey showed that total student aid in twenty-five colleges increased from $1,730,000 in the 1948–49 academic year to $4,000,000 in 1952–53—more than double. Colleges no longer can continue such generous aid, and parents will have to look to tax relief to get the financial help they need for the children's education, he declared. Dr. Schlegel considers such tax relief justifiable. He pointed out that to encourage industry to keep plants modernized, the tax law proposes to grant two-thirds of the depreciation in the first five years. (*N. Y. Times*, June 6, 1954)

Family Medical Costs and Voluntary Health Insurance in U. S.

Extent of voluntary health insurance—Over 87 million people, or 57 per cent of the population of the United States are enrolled in voluntary health insurance and protected against part of the costs of hospital service, and over 74 million people, or 48 per cent, are protected against part of cost of surgical and other physicians' services. Expansion since 1940 has been phenomenal; then approximately 9 per cent of the population was enrolled in hospital insurance and only 4 per cent covered by surgical.

Enrollment by income—For families with incomes under $3,000, 41 per cent have health insurance; between $3,000 and $5,000, 71 per cent; $5,000 and over, 80 per cent. The median income in families with some insurance is approximately $5,000.

Expenditures for personal health services—Total annual charges incurred by families in the U. S. are 10.2 billion dollars; of all charges incurred by families, 15 per cent is covered by insurance benefits; average charges for all personal health services is approximately $207 per family. The families with insurance incurred a total median cost over twice as great as those without insurance, $145 compared with $63.

The costs of personal health services are unpredictable for the individual family but relatively predictable for a group of families. Costs as such are not an issue; 10 billion dollars is not too much for the country to spend annually for personal health services. The problem is how to spread this cost equitably so that no one family incurs a heavy cost at any one time. The median per cent of income paid out for personal health services by all families is 4.1. Among insured families the lowest income group pays out a higher proportion of income than the same income group among the uninsured.

A test of the adequacy of health insurance benefits is the degree to which they cover the incurred charges. For all services 21 per cent of the families had received some service for which insurance benefits had been paid in whole or in part. Fifty-nine per cent of families with hospital costs who carried hospital insurance had 80 per cent or more of their cost covered. Eighteen per cent of the families had 60 per cent or less of their hospital costs covered by insurance. If there is any consensus as to how great a proportion of surgeons' charges should be covered by insurance, it is accurate to say that families below certain incomes should have all or nearly all of the costs of surgery covered. The payments made by insurance for surgical costs fall short of equaling the total charges.

There is a great demand for maternity benefits, and they appear to have a firm place in health insurance contracts. One-half of obstetrical cases with insurance had 60 per cent of the charges covered, and one-half had less than 60 per cent covered.

Indebtedness—Fifteen per cent of all families are in debt for 900 million for health services; approximately 7.5 million families have a medical debt, average debt being $121. *A greater proportion of families with children—21 per cent—have a medical debt than those without children.* This is another way of saying that increased financial responsibilities are incurred in families with children and that medical indebtedness is distributed unevenly. (From *National Family Survey of Medical Costs and Voluntary Health Insurance*, O. W. Anderson, Health Information Foundation, New York, 1954, 80 pp.)

Tuition Aid for Faculty Children

A grant of more than $100,000 to promote and develop tuition-free exchange of faculty children among colleges and universities has been made by the Ford Foundation's Fund for the Advancement of Education. It provides $38,000 to Williams College as fiscal agent the first year and $71,000 to the Tuition Exchange, a non-profit organization situated in Williamstown, Mass., for operating the plan during 1955-59.

Dean Robert R. R. Brooks of Williams College, who will administer the program for the first year, explained that the central idea of the tuition exchange was not new but up to now it had been limited to exclusive agreements between colleges. Under the present plan the faculty child from any member college is eligible for free tuition at any other college in the pool. Faculty children may also include children of professional, research, administrative, clerical and maintenance staffs, as well as teachers.

The program now encompasses seventy-three colleges and universities throughout the country. Some of the Eastern members are Princeton, Dartmouth, Rutgers, Columbia, Barnard, Sarah Lawrence, Vassar, Colgate, Sweet Briar, Goucher, Skidmore, Mt. Holyoke, Hobart, and Johns Hopkins. The four charter members of this plan, started seven years ago on a limited basis, were Williams, Amherst, Wesleyan, and Bowdoin.

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